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PESTICIDES ABSTRACTS (formerly Health Aspects of Pesticides Abstract Bulletin) is a monthly publication of the Management Support Division of the Office of Pesticides and Toxic Substances, Environmental Protection Agency.

The purpose of this publication is to foster current awareness of the major worldwide literature pertaining to the effects of pesticides as defined in the Table of Contents. The publication represents a monthly review of more than 2,000 primary and secondary sources. A list of periodicals from which articles have been abstracted appears annually in the January issue. Subjects and authors of abstracted articles are cross-referenced in quarterly and annual indexes. Reprint requests should be directed to the author of the complete article.

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81-1501. Varkonda, S. (Res. Inst. Agrochem. Technol., Bratislava, Czechoslovakia) **Tendencie vo vyskume a vyvoji pesticidov. [Trends in pesticide research and development.]** *Agrochemia* 21(1): 11-13; 1981 (3 references) (Czech).

Currently pesticides provide the only reliable protection against severe crop losses. However, the use of chemicals in combination with biological factors in integrated crop protection programs is suggested to offer a safer and promising alternative. In a few instances alternative control methods are already equivalent to pesticides for pest control. However, biological methods such as the use of viruses, bacteria, predatory insects and improvement of strain resistance are considered unlikely to replace pesticides in the foreseeable future as viable pest control methods. The most promising methods are concluded to be improvement of crop resistance to pests, the application of pest predators and parasites, the use of microorganisms and genetic control methods. The trend towards the establishment of comprehensive integrated systems of all available methods is discussed. New, highly target-specific, pesticides are the key compound of these systems in many instances. The need for target-specific active substances is concluded to be the driving force behind the continued search for new pesticides.

81-1502. Anonymous **Friends of the Earth file petitions against pesticide drift.** *Am. Bee J.* 120(5): 363; 1980.

Two petitions presented by the Friends of the Earth are designed to offer protection from pesticide drift. In particular, efforts are underway to have beehives listed as protected property from pesticide spray or drift. The petitions suggest that aerial sprayers must obtain written permission from persons and property owners before spraying closer than 1000 ft (304.8 m). Ground sprayers must have permission to spray within 250 ft (76.2 m). A point system is proposed to penalize pilots who spray without this permission.

81-1503. Smirnoff, W. A.; Juneau, A. (Laurentian For. Res. Cent., Canadian For. Serv., Dep. Environ., Sainte-Foy, Quebec G1V 4C7, Canada) **Results of aerial spraying with *Bacillus thuringiensis* against the spruce budworm in Quebec in 1975.** *Ann. Soc. Entomol. Que.* 24(3): 131-138; 1979 (9 references).

In 1975, 91,000 ha of spruce budworm infested forest were treated with *Bacillus thuringiensis*. Sprayed blocks were monitored intensively for deposit assessment, larval mortality and defoliation. The average deposit for all experimental blocks was 26 *B. thuringiensis* colonies/cm² with only 12% receiving the required deposit of ⩾ 50 colonies/cm². In areas treated with *B. thuringiensis* + chitinase, with the required amount of chitinase and proper timing of application, larval mortality averaged 91%. The defoliation of growth was 73%, but in some areas it did not exceed 20%. There was no damage on previous foliage, even though the larval population averaged 51 larvae/45 cm of branch tip. In certain blocks treated with formulations containing sorbitol, the spraying was delayed for 6 days after peak third instar larvae was reached and severe damage to current year growth resulted. Larval populations prior to treatment were 70 larvae/45 cm of branch tip, which exceeded the recommended limit of 35 larvae necessary to obtain good foliage protection with *B. thuringiensis*. Larval mortality after treatment was 94%.

81-1504. Sperl, G. T.; McKae, J. (Dep. Nat. Sci., Univ. Michigan, Dearborn, MI 48128) **Microbial growth on 2-bromobutane.** *Antonie van Leeuwenhoek J. Microbiol. Serol.* 46(4): 331-341; 1980 (23 references).

The possible effects of microorganisms on the toxicity of 2-bromobutane was studied. *Arthrobacter* 2BB was incubated with 2-bromobutane (supplied in the vapor form) as the sole carbon and energy source. Growth studies and oxygen consumption studies were performed. Bromide was determined with as ion exchange resin for the separation of chloride from bromide. Almost all bromide was found to be liberated before the organism showed macroscopic signs of growth. It was suggested that the dehalogenating mechanism might not be due to the organism. Oxygen consumption studies showed that the initial conversion of 2-bromobutane is a spontaneous chemical hydrolysis. A metabolic pathway for utilization of 2-bromobutane by *Arthrobacter* 2BB is proposed.

81-1505. Maksymov, J. K. (Eidg. Anst. Forsliche Versuchswes., CH-8903 Birmensdorf, Switzerland) **Biologische bekampfung des pappelspinners *Stilpnotia salicis* L. (Lepi., Lymantriidae) mit *Bacillus thuringiensis* Berliner. [Biological control of the satin moth *Stilpnotia salicis* L. (Lepidoptera: Lymantriidae) with *Bacillus thuringiensis* Berliner.]** *Anz. Schaedlingskd. Pflanz. Umweltschutz* 53(4): 52-56; 1980 (16 references) (German).

Successful control of satin moth larvae was achieved in May of 1978 by spraying *Bacillus thuringiensis* suspension from a helicopter over a 100 ha area in western Switzerland. Before treatment, larval mortality due to parasites was 9%. Treatment increased mortality to 92-94% 1 wk after spraying. Leaves of treated poplar trees were found to be coated with 140,000-3,500,000 spores/cm².

81-1506. Cairns, T.; Fishbein, L.; Mitchum, R. K. (Dep. Health & Hum. Serv., Natl. Cent. Toxicol. Res., US FDA, Jefferson, AR 72079) **Review of the dioxin problem. Mass spectrometric analyses of tetrachlorodioxins in environmental samples.** *Biomed. Mass Spectrom.* 7(11-12): 484-492; 1980 (82 references).

Information regarding 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) is reviewed. TCDD occurs as an impurity in chemicals, such as the herbicide 2,4,5-T. The formation and occurrence of TCDD in the environment are discussed. Due to its chemical stability and lipophilic nature, TCDD released into the environment may accumulate in vegetation and animal life. Various pharmacokinetic studies have indicted that TCDD is rapidly and extensively absorbed from the gastrointestinal tract and is mainly excreted in the feces. Liver, adipose tissue, skin and muscle are the principal storage sites. TCDD induces frameshift mutations in *Salmonella typhimurium* TA 1532. No increased neoplasm occurrence was noted when TCDD was fed to Sprague-Dawley rats of both sexes. Human illness has been reported following industrial accidents and includes the development of chloracne. Analytical considerations are discussed in detail. Mass spectrometry is the method recommended for TCDD analysis. The findings of a Consensus Forum among the United States FDA, EPA, and Department of Agriculture of NIEHS, concerning the analytical methods available for TCDD, are reviewed. Low resolution mass spectrometry, atmospheric pressure ionization mass spectrometry, high resolution mass spectrometry and metastable transitions (detected with gas chromatography mass spectrometry) are discussed.

81-1507. Anonymous **Pesticide residues in human fat.** *Br. Food J.* 83(900): 19; 1981.

The levels of organochlorine pesticide residues and allied compounds were investigated in 236 samples of human fat by the British government. A reduction of DDT levels was noted when the findings were compared with a previous, similar study. This reduction is probably due to the restrictions placed on DDT use by many countries in the world. A slight decrease was also found in dieldrin concentrations indicating the continuation of a slow downward trend. Hexachlorobenzene residues appeared to have increased over the previous study. Organochlorine pesticide residues were still lower in the samples of human fat from England than they are in other European countries.

81-1508. Gloag, D. (Author address not given) **Pollution and people: perspectives and priorities.** *Br. Med. J.* 282(6268): 970-972; 1981 (19 references).

A discussion is presented of factors involved in assessment of the effects of pollutants, particularly pesticides, on human health. It is noted that the pesticides registered in the United States use about 500 active ingredients, of which a substantial number are toxic, mutagenic or carcinogenic. However, it is pointed out that in most cases there is no direct information about safe levels. Therefore, it is difficult to determine if detected levels should be of concern. It is suggested that highly publicized accidents or disasters involving chemical pollutants illustrate their hazards, but also may create an unnecessary atmosphere of hysteria. Cancer rates are also discussed. It is pointed out that no direct evidence of the carcinogenicity of pesticides has been found in man, despite heavy exposure in some occupational groups. Liver cancer is the main form of cancer induced by pesticides in animals. However, there has been no general increase in liver cancer in developed countries since persistent pesticides were introduced. Considerations necessary for development of legislation concerning chemical pollutants are discussed. Assessment of cost-benefit relationships is emphasized.

81-1509. McGaughey, W. H. (US Grain Mark. Res. Lab., Agric. Res., SEA, USDA, Manhattan, KS 66502) ***Bacillus thuringiensis* for moth control in stored wheat.** *Can. Entomol.* 112(3): 327-333; 1980 (7 references).

Pilot tests on the effectiveness of *Bacillus thuringiensis* for control of Indian meal moths in wheat were made. Newly harvested hard red winter wheat was placed in 20 cylindrical corrugated steel bins. One mo later the 10-cm-deep surface layers of wheat were removed, mixed with aqueous suspensions of a WP formulation of *B. thuringiensis* at dosages of 100, 125 or 150 mg of formulation/10 ml water/kg of wheat, then layered evenly over the surface of the bins. The wheat was infested with Indian meal moth and almond moth when treated. The treatment effectively reduced moth populations by > 81%. Insect feeding damage was reduced by > 92%. Webbing of the grain surface was also reduced or prevented.

81-1510. Smirnoff, W. A. (Laurentian For. Res. Cent., Canadian For. Serv., Sainte-Foy, Quebec G1V 4C7, Canada) **Results of aerial treatments with *Bacillus thuringiensis* against spruce budworm, *Chroistoneua fumiferana*, during 3 consecutive years.** *Can. Entomol.* 112(8): 857-859; 1980 (7 references).

In 1976, a 40 ha experimental block was established in Chicoutimi County, Quebec, in a spruce budworm infested stand. The treatment block was composed of 80% 50-yr-old balsam fir, 9-15 m high, with white spruce, black spruce, and paper birch as companion species. Larval populations before and after treatment were determined. The formulation used was composed of 50 parts *B. thuringiensis* concentrate, 20 parts 70% sorbitol solution, 30 parts water, 3.0 ml/ha of Chevron sticker, 10,000 nephelometric units of chitinase/ha, and 0.1% nigrosine dye. Deposits (colonies/cm^2) on agar plates were 35.0 in 1976, 29.5 in 1977, and 36.3 in 1978. Larval mortality was 80.0, 66.4 and 70.8% in 1976, 1977 and 1978, respectively. Treatment efficiencies were 62.0% in 1976, 59.8% in 1977, and 54.9% in 1978. It was concluded that treatment with *B. thuringiensis* for 3 consecutive yr will maintain stand conditions at high levels of vitality despite yearly re-infestation of the block.

81-1511. Kumra, V. K.; Singh, R. (Banaras Hindu Univ., Varanasi, India) **Pollution from chemical, plastic and rubber industries: the case of Kanpur City.** *Chem. Age India* 31(11): 1143-1144; 1980 (6 references).

Environmental pollution from chemical, rubber and plastics industries in Kanpur City is discussed. Characteristics of waste water from sample industries in the area are presented in tabular form. Wastes from a pesticide and chemical plant were found to have a pH of 8.0, and contained 70 mg/l dissolved solid, 30 mg/l suspended solids, 140 mg/l BOD and 30 mg/l oil and grease. Worker exposure to toxic substances in the industrial environment and discharge of pollutants into public sewers are also considered. The need for pollution control procedures and regulations is noted.

81-1512. Anonymous **Another call for a ban on 2,4,5-T.** *Chem. Week* 128(13): 23; 1981.

A renewed call for a ban on production of the herbicide 2,4,5-T was expressed by the International Federation of Chemical, Energy and General Workers Unions (ICEF). Risks of soft-tissue cancer associated with exposure at the manufacturing level are among the reasons for requesting the ban. A Swedish study indicates that the exposure levels to dioxin which are encountered during the manufacturing phase can induce cancer in a very short time, and that a person so exposed is 6.8 fold more likely to develop soft-tissue sarcoma than an unexposed person. Such exposure increases the risk of contracting malignant lymphoma 4.8 fold.

81-1513. Aitio, A.; Vainio, H. (Tyoterveyslaitos, SF-00290 Helsinki 29, Finland) **Dioksiinit. [Dioxins.]** *Duodecim* 96(12): 833-835; 1980 (16 references) (Finnish).

Of the chlorinated dibenzo-*p*-dioxins, all of which are somewhat toxic, 2,3,7,8-tetrachlorodibenzo- *p*-dioxin (TCDD) is regarded as having the most powerful toxic action per unit wt. Its LD50 for male guinea pigs is 0.6 μg/kg. The LD50 for mice is 280 μg/kg. TCDD metabolizes very slowly, with a half-life in rodents of 3-4 wk. After the Seveso incident in December 1976, human birth defects rose from 41 in the area in 1977 to 90 in 1978. It is also reported that at least 16 previous incidents of this type have occurred, but that information concerning them has been suppressed (Monsanto Chemicals 1949, Lugwigshafenissa 1953, Amsterdam 1963, Czechoslovakia 1964). Dioxins exist as impurities in Agent Orange (2,4,5-T + 2,4-D), which was banned for use as a defoliant in forestry by the United States EPA in 1979. In Finland, relatively little use is made of 2,4,5-T, in which TCDD often appears as an impurity.

81-1514. Barclay, H. J. (Dep. Biol. Sci., Simon Fraser Univ., Burnaby, British Columbia, Canada) **Models for the sterile insect release method with the concurrent release of pesticides.** *Ecol. Model.* 11(3): 167-177; 1980 (17 references).

Four distinct mathematical models were developed in an effort to determine whether or not the release of pesticides in conjunction with the release of sterile individuals would further reduce the pest population equilibrium. The models discussed include single species (1 life-stage), single species (2 life-stages), 2 species in competition, and pest species under predation. In each case the derivation of the model is described and an abbreviated description is given of the behavior of the model. It was predicted that single species would generally have their equilibrium reduced more with the release of both sterile individuals and pesticides than with the release of only steriles. The feasibility of the combination program decreases as biotic interactions become more important. It is predicted that the sterile release program would be hindered by the release of pesticides when predation of the pest species is heavy.

81-1515. Treshow, M. (Dep. Biol., Univ. Utah, Salt Lake City, UT 84112) **Pollution effects on plant distribution.** *Environ. Conserv.* 7(4): 279-286; 1980 (22 references).

The effects of pollution on plant distribution are reviewed. The categories of pollutants discussed include heavy metals, acid rain, fluoride, photochemical pollution, radiation and pesticides. Impacts of pesticides include the programmed removal of climax forest types in Vietnam, which led to the leaching away of stored nutrients. The widespread use of herbicides in the United States has also led to changes in the species diversity of terrestrial plants. The mechanisms of action of pollutants on plant distribution are discussed. It is concluded that both inadvertent changes in distribution, such as the release of pollutants into the atmosphere by industry; and planned changes, such as the removal of certain plant-types for agricultural purposes, occur.

81-1516. O'Callaghan, D. P.; Gallagher, E. M.; Lanier, G. N. (Coll. Environ. Sci. & For., State Univ. New York, Syracuse, NY 13210) **Field evaluation of pheromone-baited trap trees to control elm bark beetles, vectors of Dutch elm disease.** *Environ. Entomol.* 9(2): 181-185; 1980 (14 references).

Over 250 diseased or unwanted elm trees *(Ulmus americana)* were killed with the herbicides cacodylic acid (Silvisar 510) or MSMA (Silvisar 550), applied either to axe-frills or by pressure injection. Elms thus poisoned and baited with the pheromone multilure, were mass-attacked by elm bark beetles but more than 87% of the potential brood was effectively eliminated. A decline in the Dutch elm disease rate accompanied brood elimination. It is suggested that this trap tree technique will make a positive con-

tribution to Dutch elm disease control programs by enhancing existing sanitation procedures and allowing tree removal to proceed in an orderly manner, rather than on the urgent schedule now necessary to prevent new infections vectored by emerging beetles. (Author abstract by permission)

81-1517. So, C. L. (Dep. Geogr. & Geol., Univ. Hong Kong, Hong Kong, Hong Kong) **Mercury in estuarine sediments: spatial distribution and redistribution.** *Environ. Int.* 4(3): 265-267; 1980 (29 references).

This study reviews the available data concerning mercury in estuarine sediments to provide a framework for monitoring pollution. Mercury occurs in sediments associated with several functional groups including NH, SH, COOH, and phenol groups. It is difficult to determine how much of the adsorbed mercury is exchangeable from the particulate matter in the estuaries. Comparative studies have indicated the significance of the suspended particulate fraction of the sedimentary load. It has been suggested that estuaries, where much sedimentation occurs, act as reservoirs for considerable mercury-laden particulate matter. The total amount of mercury in water samples is largely governed by the amount of suspended matter. The higher the suspended load, the higher the mercury content of the water sample. Resuspension from the sediment bed can be a significant factor in remobilization and transfer of mercury. This resuspension process is affected by many factors. It is suggested that post-depositional migration occurs in sediments, with mercury going into solution in the surrounding water as an organometallic complex.

81-1518. Subramoniam, A.; Jamuna, R.; Jayaraman, K. (Dep. Mol. Biol., Madurai Kamaraj Univ., Madurai 625021, India) **Temperature-dependent activity of mosquito larvicidal factor(s) present in *Bacillus sphaericus* 1593-4 and 1691.** *Experientia* 37(3): 288-289; 1981 (7 references).

Studies were performed to determine the effects of heat on the larvicidal activities of *Bacillus sphaericus*. Strains 1593-4 and 1691 were killed, and cell extracts containing larvicidal activity were made. Extracts were added to cultures of mosquito larvae that had been kept at either 23-25°C or 33-35°C. The LD50 values (μg protein of killed cells) were calculated for 2 species of mosquito for extracts from sporulating 1593-4 and 1691 cells and from heat killed vegetative 1593-4 cells. All LD50 values from 33-35°C cultures were lower than the LD50 values from 23-25°C cultures for both mosquito species. Heat killed vegetative cells resulted in the least toxic extracts; LC50 values were 101 and 603 for 33-35°C and 23-25°C, respectively. Sporulating 1593-4 cell extracts resulted in LC50 values of 22 and 12.7 for the high and low temperature cultures, respectively. The mechanisms of heat dependence appear to be related to heat dependent chemical interactions in the gut of the mosquito larvae.

81-1519. Facteau, T. J.; Rowe, K. E. (Mid-Columbia Exp. Stn., Oregon State Univ., Hood River, OR 97031) **Response of sweet cherry and apricot pollen tube growth to high levels of sulfur dioxide.** *J. Am. Soc. Hortic. Sci.* 106(1): 77-79; 1981 (13 references).

Studies were conducted on the effects of sulfur dioxide (SO_2) on pollen tube growth. In 1978 apricot flowers were fumigated at 0, 0.5, 3.0, 33.0 and 96 mg SO_2/m^3 for 0-72 hr. Cherry flowers were fumigated with 0, 0.4, 1, 2, 5 and 6.5 mg SO_2/m^3 for 0-72 hr. In 1979 apricot flowers were fumigated for 0, 2, 4, 8 and 24 hr at concentrations of 0, 2, 5, 7, 14 and 32 mg SO_2/m^3. Cherries were fumigated at the same time intervals at 0, 2, 6 and 14 mg SO_2/m^3. Pollen tube growth was subsequently measured and expressed as the percent of style length, based on the longest tube visible. Pollen tube growth (PTG) of apricot was reduced as growth [expressed as the log of the product of exposure time (hr) × mg SO_2] increased. Controls exhibited 98.5% PTG. A PTG of 91.6% was observed for a *ln* dose 4.0. A *ln* dose of 5.7 resulted in a 45% PTG, and a maximum *ln* dose of 7.7 resulted in a PTG of < 1%. The results of the sweet cherry experiments indicated a response similar to apricot. The apricot experiments indicated a sharp threshold effect, but the cherry studies were variable; a threshold was indicated in the 1978 studies, but a linear response was observed in the 2nd year.

81-1520. Holliday, R. J.; Putwain, P. D. (Dep. Bot., Univ. Liverpool, Liverpool L69 3BX, England) **Evolution of herbicide resistance in *Senecio vulgaris*: variation in susceptibility to simazine between and within populations.** *J. Appl. Ecol.* 17(3): 779-791; 1980 (30 references).

This investigation was made to examine variation in susceptibility to simazine between populations of *Seneca vulgaris* which had received regular applications of simazine. A second objective was to search for a population exhibiting superior resistance to simazine and to determine the genetic basis of variation in susceptibility to the chemical. Forty-six different populations were collected from several different fruit farming locations in England. A positive, linear relationship was noted between percent survival of a population and the number of consecutive years simazine had been applied. This would indicate that natural selection had occurred. In populations originating from an apple orchard in Suffolk, intra-population variation in susceptibility was investigated. It was concluded that the process of natural selection for resistance to simazine in *S. vulgaris* populations is more complex than laboratory induced processes.

81-1521. Tyrell, D. J.; Bulla, L. A., Jr.; Andrews, R. E., Jr.; Kramer, K. J.; Davidson, L. I.; Nordin, P. (Div. Biol., Kansas State Univ., Manhattan, KS 66502) **Comparative biochemistry of entomocidal parasporal crystals of selected *Bacillus thuringiensis* strains.** *J. Bacteriol.* 145(2): 1052-1062; 1981 (34 references).

Various methods were used to compare parasporal crystals of 5 strains of *Bacillus thuringiensis*. Growth characteristics were determined, and electron microscopy, polyacrylamide gel electrophoresis, amino acid analysis, tryptic peptide mapping, immunological analysis, and insecticidal activity determinations were conducted. The results indicated that *B. thuringiensis israelensis*, which is toxic to dipteran insects, produced crystals that were structurally, biochemically, and immunologically different from the 4 lepidopteran-toxic *B. thuringiensis* subsp. (*kurstaki, tolworthi, alesti* and *berliner*). These 4 subspecies produced crystals that were similar structurally, biochemically, immunologically and functionally. All subspecies contained protoxic subunits with a molecular wt of about 1.34×10^5 within the crystalline inclusion bodies. However, polyacrylamide gel electrophoretic patterns of solubilized crystals indicated that *B. thuringiensis* subsp. *israelensis* contained a small molecular wt component not present in the other subspecies. Differences were also noted in amino acid composition and tryptic peptide fingerprints.

81-1522. Ewen, A. B.; Mukerji, M. K. (Res. Stn., Agric. Canada, Saskatoon, Saskatchewan S7N 0X2, Canada) **Evaluation of *Nosema locustae* (Microsporida) as a control agent of grasshopper populations in Saskatchewan.** *J. Invert. Pathol.* 35(3): 295-303; 1980 (9 references).

Tests of the pathogen *Nosema locustae* as a biological control agent in western Canada to determine its infective properties on grasshoppers, to monitor its development in grasshopper populations, to determine if the prevalence of infection and mortality increased with time, and to determine its effect on the reproductive potential of the grasshopper populations were performed. Within 4-5 days of exposure, 50% of all populations of *Melanoplus sanguinipes, M. packardii,* and *Camnula pellucida* were infected. Maximum numbers of each species were infected between 9 and 12 wk after application. A 20% reduction in the population of *M. sanguinipes* was evident by wk 4 and further reduced to 50% by wk 9. The maximum reduction in population (60%) was achieved by wk 12. Egg production in *Melanoplus* sp. was considerably lowered.

81-1523. Cook, R. R. (Dow Chem. Co., Midland, MI 48640) **Dioxin, chloracne, and soft tissue sarcoma.** *Lancet* 1(8220): 618-619; 1981 (4 references).

In this letter-to-the-editor, a case of malignant fibrous histiocytoma is presented which occurred in an employee presumably exposed to TCDD. This case is in addition to 3 other cases presented in an earlier paper. All 4 patients were cigarette smokers. Two of the previously reported cases exhibited malignant fibrous histocytomas. Each had frank chloracne. Case 3 had a liposarcoma and was the only man not working in a TCP processing area, but had been employed in a plant producing 2,4,5-T. While no cause-effect relationship was been proven, it is suggested that smokers who exhibit chloracne as a consequence of substantial TCDD exposure may be at increased risk of fibrous soft tissue sarcomas.

81-1524. Odhiambo, T. R. (Int. Cent. Insect Physiol. & Ecol., Nairobi, Kenya) **Linking basic research to crop improvement programs for the less developed countries: biological control of insects.** In: *Linking Research to Crop Production.* Staples, R. C., ed. (Plenum Press: NY): pp. 153-172; 1980 (24 references).

The link between basic research and control of insects to protect crops in less-developed countries is discussed. Background information includes data on food production, population and distribution. Mixed cropping is less efficient from a standpoint of mechanical farming, fertilizer use and pesticide use; however, it provides a higher yield than monoculture techniques. Crop resistance is an important concept; the use of insect resistant crops supplements mixed cropping. The various types of resistance are discussed. The use of insect resistant crops as be the first line of attack in the endeavor to reduce insect depredations is recommended.

81-1525. Huffaker, C. B. (Div. Biol. Control, Dep. Entomol. Sci., Univ. California, Berkeley, CA 94720) **Use of predators and parasitoids in biological control.** In: *Linking Research to Crop Production.* Staples, R. C., ed. (Plenum Press: NY): pp. 173-199; 1980 (55 references).

The use of predators and parasitoids in biological control is reviewed. The basic concepts discussed are controlling and regulating host populations by predators and parasites. The empirical basis of biological control is the large number of cases of successful biological control of pests. The theoretical basis is presented as a series of equations and graphs predicting and describing the relationships between host population size and predator or parasite population dynamics. Several case studies illustrating ecological principles are described in detail. There are many examples of chemical and biological control mechanisms being combined to manage pests. Most cases involve restoration of biological control that was disrupted by chemical pest control. Others involve pesticide-induced pest problems, including cases of pesticide resistance. Examples of integrated methods are given for combating pests of greenhouses, oil palms, cotton, and sugarcane. All of these are based on fairly low chemical use with the chemicals being applied at selective, maximum effect, times.

81-1526. Luepke, N. P., ed. (Inst. Pharmacol. & Toxicol., Univ. Muenster, Munster, BRD) **International workshop on monitoring environmental materials in**

specimen banking. In: *Monitoring Environmental Materials and Specimen Banking.* (Martinus Nijhoff Publ.: The Hague): pp. 1-84; 1979.

Conclusions, recommendations, and general information resulting from an international workshop on the monitoring of environmental materials are presented. It was recommended that priorities be established regarding the pollutants to be monitored. Predicted exposure, size of population at risk, and severity of effects should be considered. It is suggested that organochlorine pesticides should be among the pollutants monitored. The establishment of environmental specimen banks to analyze trends in exposure to previously unrecognized pollutants is recommended. Past and present monitoring programs are described, and goals of proposed programs are outlined. Technical considerations (collection methods, equipment, storage methods), analytical methods, and cost estimation are discussed. Legal and ethical considerations are also mentioned.

81-1527. Parsons, J. S. (Author address not given) **Contaminated herbal tea as a potential source of chronic arsenic poisoning.** *N. C. Med. J.* 42(1): 38-39; 1981 (6 references).

A case is reported of a 54-yr-old man who developed symptoms of arsenic poisoning. Symptoms included acute gastroenteritis and sensorimotor polyneuropathy with limb weakness. An initial 24-hr urine sample contained arsenic at 1950 μg/l. Nail clippings contained 6000 μg/100 g arsenic. No potential sources of exposure were determined at the patient's home or work sites. It was determined that the patient routinely consumed 32-48 oz (0.95-1.493 kg) of yellow root herbal tea daily. A tea sample was found to contain 11 μg/l arsenic. When tea was prepared from 10 samples of yellow root purchased at the municipal market, each batch contained 15-68 μg/l arsenic. The most common variety of the yellow root plant is *Xanthorrhiza simplicissima*, although there are several other species. Since arsenic is not found as a natural constituent in the plant, its presence is suggested to be due to accidental contamination of the soil and streams in the plant's natural habitat.

81-1528. Hergenrather, J.; Hlady, G.; Wallace, B.; Savage, E. (Ethos Res. Group, Summertown, TN 38483) **Pollutants in breast milk of vegetarians.** *N. Engl. J. Med.* 304(13): 792; 1981 (3 references).

In a letter-to-the-editor, dietary influences on the organochlorine content of human breast milk are discussed. Samples of breast milk were gathered from 12 women who follow a strict vegetarian diet. Lipid levels in the vegetarian samples were similar to those previously reported. PCB levels were also similar between the two cohorts. However, the highest levels of DDT, DDE, oxychlordane, heptachlor epoxide, dieldrin, and β-BHC were always lower in vegetarian milk samples than the lowest value reported in the previous article. For DDT, heptachlor epoxide and oxychlordane, the mean vegetarian levels were only 1-2% as high as the average levels in breast milk in the United States. It is suggested that diet may be a major predictor of chemical pollutants in the body.

81-1529. Hay, A. (Dep. Chem. Pathol., Univ. Leeds, Leeds, England) **Disposing of dioxins by oxidation.** *Nature (London)* 290(5804): 294; 1981 (6 references).

TCDD is an extremely stable dioxin produced during the manufacture of 2,4,5-trichlorophenol. Temperatures in excess of 800°C are necessary to cause thermal degradation. When dissolved in organic solvents, such as methanol or benzene, it becomes unstable in the presence of UV light. Under field conditions TCDD can be subjected to photolytic degradation by sunlight if a suitable solvent or hydrogen donor is present. The dioxin (15 ppm) in Agent Orange (2,4-D + 2,4,5-T) is reported to have a half-life of 6 hr in the presence of sunlight. In industry, most manufacturers dispose of dioxins through high-temperature incineration. The oxidation of TCDD and other dioxins by ruthenium tetroxide (RuO_4) is currently being studied. RuO_4 is a powerful oxidizing agent which reacts with a wide range of organics and can be used in solution with water or in organic solvents with no nucleophilic character. It is suggested that RuO_4 can be safely used for the detoxification of glassware and the periodical purging of industrial reactors to counteract the accumulation of dioxin residues.

81-1530. Ayres, D. C. (Dep. Chem., Westfield Coll., Hampsted, London NW3 7ST, England) **Destruction of polychlorodibenzo-*p*-dioxins.** *Nature (London)* 290(5804): 323-324; 1981 (17 references).

The release of 2,4,5-trichlorophenol (2,4,5-T) containing 2,3,7,8-tetrachlorodibenzo- *p*-dioxin (TCDD) at Seveso highlighted the need for an efficient control procedure for the highly toxic dioxin. The concomitant formation of the dioxin and the trichlorophenol during hydrolysis of *sym*-tetrachlorobenzene had led to demands for restrictions of the use of 2,4,5-T and related herbicides. An environmental hazard is also presented by pentachlorophenol (PCP) which included the more highly chlorinated dioxins, in particular octachlorodibenzo- *p*-dioxon (OCDD). The use of polychlorophenol formulations has been banned in Sweden on the grounds that heat-stable chlorodioxins are formed during incineration; this also points to the need for degradation by chemical means. Dehalogenation of polychlorodibenzodioxins (PCDD) can be accomplished by photolysis in laboratory conditions, but material adsorbed on soil is little affected. Cleavage of the ether linkages with the formation of halophenols may be achieved by treatment with strong acids or quaternary ammonium salts., The dibenzodioxin nucleus, is however,

rather resistant to chemical attack and in the absence of a suitable control procedure the use of 2,4,5-T has been restricted in the United States by the Environmental Protection Agency. The oxidative degradation of TCDD and related compounds by ruthenium tetraoxide is reported. (Author abstract by permission)

81-1531. Szigeti, Z.; Velkey, Z. (Dep. Plant Physiol., Eotyos Univ., Budapest, Hungary) **Egyes herbicidek hatasea buza - es kukoricalevelek CO_2 fixaciojara. [Effect of some herbicides on CO_2 fixation of wheat and maize shoots.]** *Novenytermeles* 29(1): 45-52; 1980 (33 references) (Hungarian).

Four herbicides (atrazine, linuron, bromoxynil and ioxynil) were studied for their effect on the chlorophyll content and CO_2 fixation of 7-day-old intact and decapitated wheat and maize seedlings. Decapitated wheat shoots demonstrated a greater inhibition of CO_2 fixation than did the intact shoots after treatment by bromoxynil and ioxynil in light. This suggests that the uptake of these compounds is increased by the enhanced transpiration which occurs in the light. Decapitated maize shoots were also more sensitive to linuron, bromoxynil and ioxynil than were intact plants. Atrazine inhibition of carbon dioxide fixation in wheat plants required light. The tolerance of maize plants to atrazine was not affected by the light. Atrazine increased the chlorophyll content of decapitated and intact maize plants by 15-20%. All treatments carried out in the dark increased CO_2 fixation by maize.

81-1532. Yajima, Y.; Yasuda, T.; Yamada, Y. (Dep. Agric. Chem., Kyoto Univ., Kyoto 606, Japan) **Induction of DNA synthesis by 2,4-dichlorophenoxyacetic acid during callus induction in Jerusalem artichoke tuber tissues.** *Physiol. Plant.* 48(4): 564-567; 1980 (18 references).

The induction of DNA synthesis by 2,4-D was studied in Jerusalem artichokes during callus induction. Tuber discs (10 mm × 1 mm) were placed on agar containing 10^{-5} *M* 2-^{14}C-2,4-D and incubated in the dark at 25°C. At selected intervals, discs were homogenized and extracted and the radioactivity of the soluble portion was determined. The remaining discs were transferred to new agar and incubated without 2,4-D. A second group was incubated with a 1 m*l* solution of 6-^{3}H-thymidine at 1 μCi/ml; 5 Ci/mmol. ^{3}H-Thymidine incorporation was used to measure DNA synthesis. Histone and non-histone constituents were also determined. The histones were separated by polyacrylamide gel electrophoresis. During DNA synthesis the 2-^{14}C-2,4-D was rapidly incorporated into the soluble fraction. The 2,4-D level dropped when discs were placed on agar without 2,4-D. During DNA synthesis 2,4-D bound to chromatin. Electrophoresis indicated decreases in the lysine-rich histone fraction. The authors suggest that DNA induction by 2,4-D may be related to the decrease in histones and the presence of the 2,4-D, moderately lysine-rich, histone complex.

81-1533. Sharma, H. K.; Sharma, D. D.; Paliwal, G. S. (Plant Anat. Lab., Dep. Bot., Univ. Dehli, Dehli 110007, India) **Effect of chloroflurenol and FMC 10637 cambial activity and xylem differentiation on *Morus alba*.** *Phytomorphology* 29(1): 53-56; 1979 (8 references).

The effects of morphactins on cambial activity and xylem differentiation were studied in *Morus alba*. A 5 cm slice of tissue epidermis and periderm was removed from a section of stem 2 cm in diameter. The herbicide chlorflurenol and an ethylene-producing plant growth regulator, FMC 10637, were applied individually and in various combinations at 100, 500 and 1000 ppm. The growth regulator alone and in combinations resulted in reduced diameters of tracheal elements and increased the area occupied by tracheal elements. Chlorflurenol distorted the spiral elements, but FMC 10637 caused no significant distortion.

81-1534. Harvey, B. M. R.; Fraser, T. W. (Field Bot. Res. Div., Dep. Agric. North. Ireland, Belfast BT9 5PX, Ireland) **Paraquat tolerant and susceptible perennial ryegrasses: effects of paraquat treatment on carbon dioxide uptake and ultrastructure of photosynthetic cells.** *Plant Cell & Environ.* 3(2): 107-117; 1980 (40 references).

The effects of paraquat on tolerant (line RPR 1X) and susceptible (Kent) rye grass species were studied. Plants were grown in controlled environment cabinets and fitted in a fine mesh screen to allow immersion of leaves for 10 min in 2.5×10^{-4} *M* paraquat without exposure of the roots. Controls were not exposed to paraquat. Solution leakage from leaves was determined at 0, 1, 2, 4, 8 and 24 hr after treatment by immersion of leaves in distilled water and measurement of changes in water conductivity. CO_2 exchange was measured by infra-red gas analysis prior to treatment and at 1, 2, 4, 8 and 24 hr after treatment. Ultrastructure analysis of Kent indicated fusion of the thylakoid membranes and cytoplasmic damage. Leakage in treated grass did not exceed controls until 8 hr and was then greater for Kent (susceptible) than for PRP 1X (tolerant) plants. By 24 hr, leakage by treated Kent leaves was 7-fold greater than controls; leakage by PRP 1X was not greater than controls. CO_2 uptake was rapidly inhibited by paraquat in Kent, but was not affected in PRP 1X. Possible mechanisms of tolerance and susceptibility are discussed.

81-1535. Chia, L. S.; Thompson, J. E.; Dumbroff, E. B. (Dep. Biol., Univ. Waterloo, Waterloo, Ontario N2L 3G1, Canada) **Simulation of the effects of leaf senescence on membranes by treatment with paraquat.** *Plant Physiol.* 67(3): 415-420; 1981 (31 references).

Phaseolus vulgaris leaves were used to determine the ability of paraquat to simulate the effects of senescence of membranes. Leaves were harvested 12, 24, and 48 hr after treatment with paraquat at concentrations of 10 or 50 mg/*l*. Microsomal membranes and partially purified chloroplast fractions were isolated from the leaves, and

total lipids were extracted and analyzed. Wide-angle X-ray diffraction patterns were also recorded. Several senescence-related changes occurred in young plants treated with paraquat. These included increased lipid-phase transition temperatures for microsomes and chloroplasts, large increases in the sterol to phospholipid ratio of the membranes (reflecting phospholipid breakdown), and increased proportions of gel phase lipid. In addition, malondialdehyde, a product of lipid peroxidation, increased both senescent and paraquat-treated leaves. It is suggested that membrane deterioration may be due, in part, to free radical damage.

81-1536. Pfister, K.; Steinback, K. E.*; Gardner, G.; Arntzen, C. J. (DOE Plant Res. Lab., Michigan State Univ., East Lansing, MI 48824) **Photoaffinity labeling of an herbicide receptor protein in chloroplast membranes.** *Proc. Natl. Acad. Sci. USA* 78(2): 981-985; 1981 (28 references).

Studies were performed to investigate the photoaffinity labeling of herbicide receptor proteins in dwarf pea leaves and in triazine-susceptible and triazine-resistant weeds. Leaf tissue was homogenized in cold buffer for 5 sec at high speed and filtered. The filtrate was centrifuged at 100 *g* for 10 min. The pellet containing chloroplast membranes was resuspended and assayed for chloroplast photochemical activity. The chloroplast membranes were exposed to various concentrations of azido-[^{14}C]atrazine (0.07-7 μM) for 3 min, centrifuged, and removed from radioactivity. Competition experiments were conducted in a similar manner but with the addition of both labeled azido-atrazine and [^{14}C]atrazine during incubation, followed by UV irradiation. UV irradiation of chloroplast thylakoids in the presence of azido-[^{14}C]atrazine caused covalent bonding of the inhibitor to the thylakoid membranes of the pea and the susceptible weed. No binding of azido-atrazine to the membranes of the triazine resistant weed occurred. Electrophoretic analysis indicated 32-34 kDalton polypeptides were the herbicide receptor proteins.

81-1537. Fletcher, D. J.; Blum, M. S. (Dep. Entomol., Univ. Georgia, Athens, GA 30602) **Pheromonal control of dealation and oogenesis in virgin queen fire ants.** *Science* 212(4490): 73-75; 1981 (14 references).

In the fire ant *Solenopsis invicta*, sexually mature virgin females are prevented from shedding their wings and becoming functional egg layers by the presence of the mated queen. Experimental data suggest that this inhibitory effect results from the action of a relatively nonvolatile primer pheromone (or pheromones) produced by the mated queen and distributed by the workers. Target ants are both virgin queens and workers. (Author abstract by permission. Copyright 1981 by the American Association for the Advancement of Science)

81-1538. Gegenava, G. V.; Nishnianidze, N. O.; Gogiberidze, G. S. (Georgian Inst. Plant Prot., USSR) **Vliyanie sistemnykh fungitsidov na pishchevuyu tsennost' i lezhkosposobnost' plodov tsitrusovykh, ikh sanitarno-gigienicheskaya otsenka. [The influence of systemic fungicides on the nutritive value and keeping quality of citrus fruits and their sanitary-hygienic assessment.]** *Soobshch. Akad. Nauk Gruz. SSR* 100(2): 485-488; 1980 (5 references) (Russian).

The results of evaluation of the effect of the systemic fungicides benomyl, Topsin (thiophanate), BMC (carbendazin), Fundazol and Uzgen on the nutritional values and keeping quality of citrus fruits are reported. Benzimidazol and thiourea fungicides increased the sugar content and vitamin C levels in tangarines. Bendazol and benomyl increased the yield of essential oils. All fungicides reduced the loss from rot and thus increased the keeping time of oranges. Benomyl levels 1 mo after spraying in orange rind and flesh were 0.7 mg/kg, significantly lower than the maximum permissible concentration.

81-1539. Donatelli, L.; Lampa, E.; Creso, E. (Inst. Pharmacol. & Toxicol., First Fac. Med., Univ. Naples, Naples, Italy) **Considerations on the epidemiology of the Seveso accident.** *Toxicol. Eur. Res.* 3(1): 9-16; 1981 (37 references).

On July 10, 1976, a reactor at a chemical plant in Seveso, Italy, accidentally released into the atmosphere a toxic cloud containing 2,4,5-trichlorophenol, 2,4,5-sodium trichlorophenate, 2,3,7,8-TCDD, predioxins, ethylene glycol, sodium hydroxide, and possibly tetrachlorobenzene residues. A historical account of the accident is presented. The investigations that have been carried out are evaluated. A definition of the magnitude and consequences of the accident is attempted. Soil samples were taken from the exposed areas, and the entire area was divided into 3 subsections based on soil TCDD levels. The choice of TCDD as the only toxicant measured, the sampling sites chosen, and the analysis methods used, are criticized. On the basis of human mortality or damages suffered by the population, the Seveso incident is not concluded to be a severe disaster. The incidence of chloracne, observed especially among children, was low. Recovery generally occurred within 1 yr, leaving no permanent damage. Data have revealed no teratogenicity, mutagenicity or carcinogenicity. The loss of building use and crops was also temporary. It is concluded that reliable data are available regarding the epidemiologic pattern of human health damages related to the accident.

81-1540. Caceres, J. R.; Rojas-Garciduenas, M. (Dep. Biol., Inst. Technol. & Estud. Super., Sucursal Correos J., Monterrey, Nuevo Leon, Mexico) **Response of drought-resistant and drought-susceptible maize cultivars to chlormequat application.** *Turrialba* 30(1): 25-29; 1980 (8 references).

Seeds of drought-resistant and drought-susceptible maize cultivars were treated with chlormequat chloride (a plant growth regulator) at 5000 ppm. Differential effects on transpiration rate, plant height, foliar area, stem/root ratio, and capacity of recovery from drought-stress were determined. Data indicate that the transpiration rate of drought-susceptible plants is lowered by chlormequat chloride, while the drought-resistant plants remain unaffected. This reduced transpiration could not be attributed to either differences in leaf area or in stem/root ratio. No differences between cultivars in drought-stress or capacity to germinate in high-molarity solutions were found. It was concluded that intracellular factors are probably responsible for differences in behavior between drought-susceptible and drought-resistant cultivars.

81-1541. Chykaliuk, P. B. (Author address not given) **Bibliography of glyphosate.** *Tx. Agric. Exp. Stn. Misc. Publ.* 1443: 1-87; 1980 (1026 references).

This is a bibliography concerning glyphosate (Roundup), a herbicide formulation of the isopropylamine salt of glyphosate. The herbicide is effective on annual and biennial species of grasses, sedges, and broad-leaved weeds. It is used worldwide on crops such as corn, wheat, soybeans, and cotton. The bibliography contains 1026 references arranged alphabetically by author and dealing with the following subjects: absorption and translocation, additives and tank mixes, aquatic use, bioassay and analysis, carrier aspects, crop phototoxicity, cultural aspects, drift, environmental effects, growth stage, harvest aid, irrigation system, metabolism and degradation, physiology and biochemistry, residues, seed germination, selectivity, soil aspects, toxicity, turfgrass and pasture, volatility, and weeds controlled.

81-1542. Bousfield, W.; Flavell, T. (State & Priv. For., Region 1, For. Serv., USDA, Missoula, MT) **Effects of Dipel wettable powder for foliage protection against western spruce budworm 1 and 2 years following aerial application.** *USDA For. Serv. Rep.* 80-9: 1-4; 1980 (1 reference).

During 1975 in the Gallatin National Forest, Dipel (*Bacillus thuringiensis* Berliner) was applied to third and fourth instar larvae of the western spruce budworm. Dosage was 1 lb in 2 gal water/acre (2.2 kg in 18.7 ℓ water/ha). Corrected budworm mortality at 21 days after application was 50.4%. Treated blocks of forest were significantly greener than untreated sections during summer aerial observations. In September 1976, defoliation was estimated for different forest blocks. The same blocks were resampled in 1977 to determine the effects 2 yr after application. Results showed that while differences in the treated and untreated blocks could be detected in the defoliation survey at 1 yr, no differences were visible after 2 yr.

81-1543. Anonymous **IPM for better use of insecticides.** *Utah Sci.* 41(1): 28-29; 1980.

A general discussion is presented of integrated pest management (IPM) techniques. Methods used in Utah for alfalfa are discussed in detail. In one county, better management led to a drastic reduction in insecticide use; 80% of the alfalfa fields were sprayed in 1970, 20% in 1978, and 2% in 1979. One method that has been successful in this situation has been timing the first cutting to disrupt the alfalfa weevil life cycle and optimize the effects of any beneficial insects in the field. One problem in pest control has been the need for a practical way of assessing pest susceptibility to an insect. A method is described in which samples of grass and insects are placed in a vial treated with insecticide. Assessment of susceptibility is made within 24 hr.

81-1544. Pluta, J.; Olszewski, Z. (Med. Acad. Wroclaw, Dep. Pharmaceut. Pharmacol., Wroclaw, Poland) **Badania zawartosci zwiazkow chlorowcopochodnych w nalewkach i wyciagach suchych. [Determination of chlorinated pesticides in tinctures and dry extracts.]** *Acta Polon. Pharm.* 37(6): 675-679; 1980 (8 references) (Polish).

Chlorinated pesticides that are soluble in organic solvents are isolated during processing alcoholic extracts of medicinal plants. Traces of chlorinated pesticides [DDT and its metabolites, DDE, DDA, HCH (BHC) and DMDT (methoxychlor)] were found in all selected samples of tinctures and dry extracts that were commercially available in 1975. Pesticide levels were determined by gas chromatography. Contamination of tinctures with DDT and its metabolites was in the range of 0.1-0.2 ppm. HCH and DMDT in tinctures were found in very small quantities (< 0.02 ppm), with the exception of *T. Colae*, which exceeded 0.4 ppm. The majority of dry extracts contained up to 0.1 ppm of DDT and its metabolites, except *Aloes siccum* extract, which contained 0.6 ppm DDT. Large amounts of DMDT (1-3 ppm) were found in dry extracts of *Belladonnae siccum*, *Aloes siccum* and *Colae siccum*. HCH content exceeded 0.4 ppm only for *Colae siccum* extract.

81-1545. Hance, R. J.; Segal, G. M. (Agric. Res. Count., Weed Res. Organ., Begbroke Hill, Yarnton, Oxford, England) **A comparison of the decomposition of atrazine and diuron in soils of different fertilizer content and pH.** *Agrochimica* 24(4): 265-273; 1980 (18 references).

Soil samples were taken from the top 10 cm of 2 fields (arable rotation and permanent grass). Organic carbon content was 1.5 and 3.5% respectively; pH was 6.9 and 5.5. Soil samples were treated with commercial formulations of atrazine and diuron. The atrazine samples were extracted after 70 days. Substantial quantities of radioactivity were extracted with methanol from all treatments. However, in some cases, especially in arable field soil at low pH, the amount of unchanged atrazine was small. The results of the study suggest that the metabolic pathways of atrazine and diuron are insensitive to wide variations in nutrient salt concentration and pH. Future metabolic studies concerning these variables were not recommended.

81-1546. Slater, R. M.; Spedding, D. J. (Chem. Dep., Univ. Auckland, Auckland, New Zealand) **Transport of dieldrin between air and water.** *Arch. Environ. Contam. Toxicol.* 10(1): 25-33; 1981 (19 references).

The transfer rate of dieldrin from water to air has been measured in a wind tunnel yielding transfer velocities in the range 2.6×10^{-5} to 1.5×10^{-4}cm/sec. The transfer rate from air to water was measured with a wetted-wall column and gave transfer velocities in the range 9×10^{-3} to 5×10^{-2}cm/sec. An analysis of the data showed that processes in the liquid phase offered no larger resistance to the transfer of dieldrin between air and water than processes in the gas phase. The results are considered in relation to the transfer of dieldrin between the atmosphere and the ocean surface layer. (Author abstract by permission)

81-1547. Mahon, R.; Balon, E. K. (Dep. Zool., Univ. Guelph, Guelph, Ontario N1G 2W1, Canada) **Quantitative collection of fishes from small fast flowing streams.** *Arch. Hydrobiol.* 90(3): 324-329; 1980 (11 references).

The use of rotenone for sampling short stretches of small, fast-flowing streams was studied. Emphasis was on the detoxification of rotenone. Six stream sections (61-88 m) were isolated with upstream and downstream blocking nets. Rotenone (ProNoxfish) was applied at 1.0-1.5 ppm. Various concentrations of $KMnO_4$ were then added, and detoxification was evaluated. At each locality the $KMnO_4$ demand of the stream water was found to be < 1.0 ppm. Application of rotenone, to a section of stream with a large quantity of standing water downstream, was recommended for reduction of affected distance to < 50 m downstream from the treated area.

81-1548. Tso, T. C. (Tobacco Lab., Agric. Res., SEA, USDA, Beltsville, MD 20705) **Modification through agricultural techniques for developing a safer tobacco.** *Banbury Rep. Ser.* 3: 181-190; 1980 (13 references).

In developing agricultural techniques with an attempt to produce a safer cigarette or tobacco product, attention has been given to the chemicals used for pest control and growth regulation. Some of these chemicals give high residues on cured tobacco leaf, and some of these residues have been found in mainstream cigarette smoke. Cigarette smoke from Prince Edward Island tobacco was analyzed for contaminants and compared to other cigarettes made from leaves grown in areas with significantly greater contamination. Almost no differences were noted in general cigarette characteristics or coal temperature, and only slight differences in the mainstream smoke for nicotine, tar, CO and CO_2. Isoprene, phenol and HCN were higher in the untreated than in the treated samples. Benzo(*a*)pyrene and total volatile phenols were lower in untreated samples. Mutagenic activities were not significantly different. A slightly higher tumorigenic activity was found during appropriate testing for the pesticide treated tobacco samples. DDT was the only pesticide that had a measurable residue level in cigarette smoke condensate of treated tobacco.

81-1549. Torrazzo, P.; Vietti, L.; Carello, M.; Anselmitti, M. P. (Lab. Chim. Prov., I-13100 Vercelli, Italy) **Mercurio e pesticidi clorurati e fosforati in risi destinati all'esportazione. [Mercury and chlorinated and organophosphorus pesticides in export rice.]** *Boll. Lab. Chim. Prov.* 5(2): 251-259; 1979 (12 references) (Italian).

Analytical methods for determining mercury, chlorinated and organophosphorus pesticides in rice are described. Levels found in samples of rice grown in the Italian province of Vercelli are reported. The study was undertaken because the rice, exported largely to Eastern Europe, must meet specific pesticide residues standards. For mercury determination the rice sample is mineralized by a mixture of sulfuric and nitric acid, treated with $KMnO_4$, and a vaporized solution is determined spectrophotometrically by atomic absorption with a cathode lamp. Chlorinated and organophosphorus pesticides were determined by gas chromatographic methods. Of 57 samples, mercury was found in 44. The maximum residue was 0.03 ppm. (0.05 of the maximum permissible level). Heptachlor was found in 19% of the samples in trace amounts. Lindane was found in 93.6% of samples at levels < 0.1 ppm (the maximum permissible level). Traces of malathion were found in a single sample.

81-1550. Staiff, D. C.; Butler, L. C.; Davis, J. E. (Health Eff. Res. Lab., Wenatchee Pestic. Res. Branch, US EPA, Wenatchee, WA 98801) **A field study of the chemical degradation of paraquat dichloride following simulated spillage on soil.** *Bull. Environ. Contam. Toxicol.* 26(1): 16-21; 1981 (8 references).

Degradation procedures that might prove useful for treatment of paraquat spills were evaluated. Simulated spills were produced in an outdoor soil plot using a liquid paraquat concentrate containing 29.1%, by wt, paraquat dichloride. Spills were contained in unglazed clay pots filled with soil and buried in the plot. Degradation by chemical reduction was tested by addition of sodium borohydride or powdered zinc + acetic acid. Decontamination by alkaline hydrolysis was tested by addition of 10% sodium hydroxide solution. Soil samples were taken 24 hr and 4 mo after treatment. Samples were analyzed for intact paraquat by spectrophotometric methods, and for volatile conversion products by gas chromatography. All treatments effectively decreased paraquat residues in the spills. Sodium borohydride was especially effective; all paraquat residues were degraded by the time the intact samples were taken. The major product formed by borohydride reduction of paraquat under these conditions was DMOBP. The powdered zinc + acetic acid treatment was nearly as effective; 99% of the original paraquat was degraded by the time of the first sample, and no further degradation was apparent after 4 mo. Essentially all the paraquat was degraded by alkaline hydrolysis within the first 24 hr, and no residue was detectable after 4 mo. It is noted that all the treatments described could present some hazard to the person performing the chemical degradation.

81-1551. Liu, D.; Thomson, K.; Strachan, W. M. J. (Environ. Contam. Div., Natl. Water Res. Inst., Burlington, Ontario L7R 4A6, Canada) **Biodegradation of pentachlorophenol in a simulated aquatic environment.** *Bull. Environ. Contam. Toxicol.* 26(1): 85-90; 1981 (18 references).

The biodegradation of pentachlorophenol (PCP) in an aquatic environment was investigated. Activated sludge served as the growth medium for bacteria, to which PCP and co-metabolites were added, with or without glucose. PCP and MCP (4-chlorophenate) were added at 2 and 5 ppm, respectively. Studies were conducted under both aerobic and anaerobic conditions, with PCP alone or with MCP, and under biotic and abiotic conditions. At various time intervals samples were extracted and analyzed for PCP and MCP. The disappearance of PCP was greatest under aerobic conditions; 100% disappeared in < 100 hr. PCP alone had a higher breakdown rate then when in the presence of MCP or glucose. This study does not completely describe conditions in a natural aquatic ecosystem, but offers a tool for investigating the interactions described.

81-1552. Marsh, J. A. P.; Davies, H. A. (Weed Res. Organ., Begbroke Hill, Yarnton, Oxford OX5 1PF, England) **Effects of dichlorprop and mecoprop on respiration and transformation of nitrogen in two soils.** *Bull. Environ. Contam. Toxicol.* 26(1): 108-115; 1981 (12 references).

The effects of the herbicides dichlorprop and mecoprop on respiration and nitrogen transformation in 2 soils was studied. The soils used were sandy loam collected from arable (Boddington Barn) and permanent grass (Triangle) fields. Moist soil was treated to give average herbicide concentrations of 10 and 100 ppm AI (~ field and 10 times field rate). Some conflicting results are reported, which may be due to changing circumstances at the time of soil collection. In the first experiment, dichlorprop at 100 ppm reduced respiration in Triangle soil and increased respiration in Boddington Barn soil. Repetition of the test 1 yr later showed less clear results. In Triangle soil, dichlorprop at 100 ppm caused a slight increase in CO_2 output initially, but subsequently no appreciable differences until after 22 hr when CO_2 evolution was less in treated soils. Dichlorprop-treated Boddington Barn soils showed an initial stimulation, followed by a reduction in respiration. Mineralization of nitrogen in Triangle soil was reduced from wk 3 and nitrification was inhibited. Treated Boddington Barn soil showed increased mineralization of nitrogen and no inhibition of nitrification. A repeat of the experiment showed less marked effects on nitrogen transformation. Studies using 100 ppm mecoprop showed initially increased respiration of Triangle soil, but then a reduction throughout the incubation period. Respiration increased for the first 14 wk in treated Boddington Barn soil. A repeat of the experiment showed that mecoprop had a much smaller effect. These data emphasize the fact that herbicide interactions are markedly affected by environmental conditions, and the need to test effects of herbicides on soil microorganisms in different soils.

81-1553. Bechard, M. (Zool. Dep., Washington State Univ., Pullman, WA 99164) **DDT and hexachlorobenzene residues in Southeastern Washington Swainson's hawks *(Buteo swainsoni).*** *Bull. Environ. Contam. Toxicol.* 26(1): 248-253; 1981 (18 references).

Pesticide residue levels in 3 species of raptors in southeastern Washington were determined. Addled eggs and nestling carcasses were collected during June of 1977 and 1978. *Buteo swainsoni, Buteo regallis* and *Falco sparverius* were collected. Frozen samples were shipped to Laurel, MD, for analysis. Samples were relatively free of organochlorine residues. The eggs contained a mean of 0.65 ppm *p,p'*-DDE, but no *p,p'*-DDT (*p,p'*-TDE) or *p,p'*-DDT. Only trace levels of heptachlor epoxide, dieldrin, oxychlordane, and PCB were found. The highest level of hexachlorobenzene (5.2 ppm) was seen in *B. swainsoni.* Clutch size and survivorship were not related to pesticide contamination.

81-1554. Horii, S.; Miyazaki, T.; Kaneko, S.; Akiyama, K.; Yamagishi, T. (Tokyo Metrop. Res. Lab. Public Health, Shinjuku-ku, Tokyo 160, Japan) **Identification of γ-chlordane in freshwater fish from the Tama River (Japan).** *Bull. Environ. Contam. Toxicol.* 26(1): 254-257; 1981 (8 references).

The contamination of freshwater fish by γ-chlordane was investigated in the Tama River of Japan. Whole-body extractions were made from specimens of *Zacco platypus* and analyzed by gas chromatography-mass spectroscopy. γ-Chlordane was identified by comparison of spectra of knowns and fish extracts, as well as retention times (on OV-17, OV-1 and OV-17/OV-210 columns). The β-isomer was separated enough to be distinguished on the OV-17 column. γ-Chlordane was present at 23 ppb (wet basis). The data indicate that chlordane is a common contaminant, but is found at low levels.

81-1555. Nigg, H. N.; Reinert, J. A.; Stamper, J. H.; Fitzpatrick, G. E. (Agric. Res. & Educ. Cent., Inst. Food & Agric. Sci., Univ. Florida, Lake Alfred, FL 33850) **Disappearance of acephate, methamidophos, and malathion from citrus foliage.** *Bull. Environ. Contam. Toxicol.* 26(1): 267-272; 1981 (9 references).

The disappearance rates of acephate, its hydrolysis product (methamidophos), and malathion total residues under simulated application conditions were determined. Acephate was applied to citrus foliage at 3 wk intervals at 0.6 g/l by high-pressure sprayer or at 2.4 g/l by mist blower. Malathion was applied at 1.5 g/l by high pressure sprayer. Leaf samples were analyzed at routine intervals. No malaoxon was detected in any sample. Malathion disappeared faster than acephate. Acephate disappeared at least as rapidly as methamidophos. The mist blower resulted in faster disappearance than the high pressure sprayer. The half-life of malathion was 5.2 days, and for acephate was 6.8 days (mist blower) and 12.6 days (high pressure).

81-1556. Madder, D. J.; Lockhart, W. L. (Dep. Entomol., Univ. Manitoba, Winnipeg, Manitoba R3T 2N2, Canada) **Studies on the dissipation of diflubenzuron and methoprene from shallow prairie pools.** *Can. Entomol.* 112(2): 173-179; 1980 (13 references).

Studies were conducted to characterize the dissipation of diflubenzuron and methoprene from shallow pools. Sod-lined pools, 5 × 4 × 1·m, were treated with either diflubenzuron or methoprene at 0.056 kg/ha. This would produce an initial concentration of 6.6×10^{-7} *M* for both compounds. The presence of these compounds was determined by bioassay and gas-liquid chromatography. Both compounds disappeared rapidly from the water. Methoprene is thought to be degraded by photoisomerism and microbial action. Diflubenzuron degraded more slowly than the methoprene. The results indicate that methoprene should not pose a long-term persistence hazard in water when used for mosquito control.

81-1557. Looney, N. E.; Cochrane, W. P. (Res. Stn., Agric. Canada, Summerland, British Columbia V0H 1Z0, Canada) **Relative effectiveness of, and residue declination values for, dichloroprop, fenoprop and naphthalene-acetic acid used to control preharvest drop of McIntosh apples.** *Can. J. Plant. Sci.* 61(1): 87-91; 1981 (7 references).

Efficacy data for dichloroprop, fenoprop (silvex) and NAA collected in 3 seasons and the NAA and dichlorprop residue levels observed in 1978 are reported. All experiments were conducted in a block of mature McIntosh trees. In 1977, trees were sprayed 16 days before harvest with 250 ppm ethephon alone or combined with 10 or 20 ppm fenoprop; 10, 20, or 40 ppm dichloroprop; 20 ppm NAA; and 20 ppm NAA + 20 ppm dichlorprop. The second spray was applied in 1977, 4 days before harvest, but no ethephon was applied. In 1978, spraying included 20 ppm NAA; 20 ppm fenoprop; 20 and 40 ppm dichlorprop; and 20 ppm NAA + 20 ppm dichlorprop. Chlorothalonil was added at 250 ppm to 20 ppm NAA and to 40 ppm dichlorprop. Dichlorprop was quite persistent in the fruit, 2 hr to 10 days after spraying, whereas NAA residues declined rapidly in the fruits on the tree. Dichlorprop levels in whole macerated apple samples increased from 0.098 ppm at 2 hr, to 0.118 ppm at 10 days, when applied at 40 ppm. When dichlorprop + chlorothalonil were applied at 40 and 250 ppm, respectively, residues decreased from 0.159 ppm at 2 hr to 0.115 ppm at 10 days. In both cases, residues were lowest at 2 days post-spray.

81-1558. Shukla, N. P. (Chem. Eng. Dep., Reg. Eng. Coll., Srinagar, India) **Transformation of pollutants in**

water. *Chem. Age India* 31(11): 1145-1148; 1980 (7 references).

The biological and chemical amplification of pollutants found in water are discussed. Due to the importance of agriculture in India, water pollution in this country is usually the result of agricultural chemicals (fertilizers, herbicides, insecticides, and fungicides) being carried by run-off or winds to surface waters. The largest water pollution problem is considered to be the deleterious effects of chemicals transported to lakes and ponds. Bioamplification of water pollutions occurs in aquatic organisms so that, while water concentrations may be acceptable, residues in aquatic organisms may accumulate to > 40,000 times the water concentrations. Biomagnification of toxic pollutants within the aquatic food chain also presents a serious problem. Average concentrations of DDT, dieldrin, and PCBs in Lake Michigan trout indicated bioconcentration factors were 3.13×10^5, 1.3×10^5, and 3.41×10^6, respectively. An equation for calculating bioconcentration factors and a chart illustrating bioamplification of mercury are presented.

81-1559. Anonymous **Organochlorines in Mediterranean seabirds.** *Environ. Conserv.* 7(4): 277-278; 1980 (7 references).

A comparison is made of four separate reports of chlorinated hydrocarbons found in Mediterranean seabirds. The studies included eggs taken from the Rhone Delta in spring of 1972, fish and bird migrants from the Po Delta during autumn of 1972, a small series of representative species collected in 1973-1975, and effects on reproduction of Audouin's gull. Average DDE levels ranged from 0.02 to 11.3 ppm; average dieldrin levels ranged from < 0.01 to 0.25 ppm; and average PCB levels ranged from < 0.01 to 52 ppm. The highest DDE levels occurred in herring gull eggs from Cyprus and a little gull collected in Malta in winter, while the highest PCB levels were found in herring gull eggs from the Rhone Delta. The levels reported are fairly typical for comparable birds throughout the more-developed parts of the world. It is concluded that there is no immediate cause for concern about Mediterranean seabirds, although it is suggested that the DDE levels in herring gull eggs and in the little gull could be continued to be watched.

81-1560. Siddiqui, M. K. J.; Saxena, M. C.; Bhargava, A. K.; Seth, T. D.; Krishna Murti, C. R.; Kutty, D. (Ind. Toxicol. Res. Cent., Lucknow 226001, India) **Agrochemicals in the maternal blood, milk, and cord blood: a source of toxicants for prenates and neonates.** *Environ. Res.* 24(1): 24-32; 1981 (26 references).

The circulating blood, breast milk, and cord blood, collected 24-48 hr after child birth from nursing Indian mothers, were examined for the presence of organochlorine insecticides (OCI). Significant levels of BHC and DDT were found in all milk, blood samples, and neonatal blood (cord blood) of mothers. No effect of social status, age, dietetic habits, or area of residence on the susceptibility of subjects examined to accumulate OCI was noticed. Significant correlations of total DDT and BHC levels were observed among maternal blood, neonatal blood, and breast milk. The presence of OCI in the cord blood indicates their passage across the placenta to prenates, whereas contamination of breast milk which is consumed by neonates could shed some light on a far greater daily intake of toxic agrochemicals by neonates. (Author abstract by permission of Academic Press)

81-1561. Kampe, W. (Landwirthsch. Unters. & Forschungsanst. Speyer, D-6720 Speyer, BRD) **Die pflanzenbauliche Bedeutung von Schwermetallen. [Agricultural significance of heavy metals.]** *Forum Staedtehyg.* 32(1): 36-40; 1981 (1 reference) (German).

Studies on the uptake of heavy metals by food plants and its hygienic and toxicological significance are reviewed. The contribution of pesticides to the heavy metal load in food plants is concluded to be negligible compared with other sources. A mercury level of 0.1 mg/kg was found in the leaves of lettuce plants grown in a soil containing 47 mg/kg mercury (origin not specified); 9.7 mg/kg were found in lettuce grown in a soil containing 475 mg/kg mercury. The availability of heavy metals present in the soil for plants decreases with rising soil pH.

81-1562. Nayshzheyn, S. Ya.; Cheginets, G. Ya.; Voronova, G. F.; Nikula, R. G.; Bezborod'ko, M. D. (A. N. Marzeev Res. Inst. Gen. & Communal Hyg., Kiev, USSR) **Materialy k obosnovaniyu predel'no dopustimoi kontsentratsii gerbitsida Banvel D vo pochve. [Substantiation of maximum permissible concentration of the herbicide Banvel D in the soil.]** *Gig. Sanit.* 46(1): 86-88; 1981 (Russian).

To substantiate the maximum permissible concentration of the herbicide Banvel D (dicamba; 2-methoxy-3,6-dichlorobenzoic acid) in the soil, the residual amounts, persistance and rate of migration were determined. Banvel D was found to persist in the soil; 13 mo after application at 5 mg/kg 44% remained. Stability of Banvel D depended upon the humus content and alkalinity of the soil. Five mo after application at 0.25 and 0.5 mg/kg, the herbicide was detected only in the top 0-20 cm soil layer. After application at 1.5 mg/kg, trace amounts of herbicide were detected in the 21-40 cm layer. Banvel D at 0.25 mg/kg did not affect the nutritional value of potato (starch and vitamin C content). It was recommended that the MPC for Banval D should be 0.25 mg/kg.

81-1563. Zecca, E.; Amaranto, C.; Pelissero, G. (Ist. Ig., Univ. Pavia, Pavia, Italy) **Ricerca epidemiologica**

sull'uso dei pesticidi nella lavorazione agricola valutazione dei residui di lindano in camponi di carne bovina di diversa provenienza. [Epidemiologic research on the use of pesticides in agriculture. Pesticide residues in meat samples.] *Ig. Mod.* 74(6): 901-909; 1980 (7 references) (Italian).

Lindane residues were determined by gas chromatography in 51 beef samples taken from 17 animals raised in the Pavia region. Levels were compared with analogous results obtained in 1973 in the Rome region prior to the passage of a law limiting the use of this pesticide in agriculture in 1975. Residues were found in anterior and posterior muscle tissues of the animals. No residues were detected in the liver. Older animals exhibited larger residues than steers. Based on average per capita beef consumption and residue levels found, the median annual per capita intake of lindane in beef dropped from 46.5 μg to 0.159 μg and of veal to 0.032 μg. It is concluded that the decrease in lindane residue levels is due primarily to the legal constraints on the use of lindane in agriculture.

81-1564. Franco, J. M.; Fernandez, M. J. (Inst. Invest. Pesq., Vigo, Spain) **Residuos de bifenilos policlorados (PCB) y DDT en tres especies de moluscos, mejillon *(Mytilus edulis)* lapa *(Patella* sp.) y nucela *Nucella lapillus),* de las rias de Vigo y Pontevedra. [Residues of polychlorinated biphenyls (PCB) and DDT in three species of mollusc: mussels *(Mytilus edulis),* limpets (*Patella* sp.), and Dogwelk *(Nucella lapillus)* of Vigo and Pontevedra Rivers.]** *Invest. Pesq.* 43(3): 709-723; 1979 (7 references) (Spanish).

PCB and DDT levels were measured in wild and raft cultured mussels, limpets, dogwelk and *Pisidia longicornis.* Seasonal and species variations of total organochlorine levels are presented in tabular and graphic forms. Organochlorine concentrations detected in mussels were 15.0-98.0 ng/g wet wt for ΣDDT and 23-1050 ng/g wet wt for PCBs. No significant differences were found when the results were compared to levels detected 5 yr earlier. Levels in 1970 were 15.0 and 100.0 ng/g wet wt for ΣDDT and PCB, respectively. Levels in 1975-76 were 16.2 and 75.2 ng/g wet wt, respectively.

81-1565. Gorovleva, L. A.; Klysheva, A. L.; Nefedova, M. Yu.; Baskunov, B. P.; Zyakun, A. M.; Ilyaletdinov, A. N. (Inst. Biochem. & Physiol. Microorg., Pushchino, USSR) **Degradatsuta gerbutsuda saturna mikroorganizmami. [Degradation of the herbicide Saturn by microorganisms.]** *Izv. Akad. Nauk Kaz. SSS Ser. Biol.* (6): 23-30; 1980 (7 references) (Russian).

Degradation of the dithiocarbamate herbicide Saturn (benthiocarb) by microorganisms isolated from rice field soil was studied. Of 6 strains isolated, only *Bacillus megaterium* 168 was found to degrade Saturn. The first metabolites were detected after 3 hr of incubation. A total of 9 metabolites were identified. The sulfoxide metabolite was found to remain for a prolonged period of time in the soil and culture medium; other products underwent further degradation.

81-1566. Saxena, M. C.; Siddiqui, M. K. J.; Seth, T. D.; Krishna Murti, C. R.; Bhargava, A. K.; Kutty, D. (Ind. Toxicol. Res. Cent., Mahatma Gandhi Marg, Lucknow 226001, India) **Organochlorine pesticides in specimens from women undergoing spontaneous abortion, premature or full-term delivery.** *J. Anal. Toxicol.* 5(1): 6-9; 1981 (18 references).

Levels of organochlorine insecticides (OCI) found in the maternal blood, placenta, and fetus of 25 preterm labor cases and spontaneous abortions were measured. These findings were then compared to similar measurements taken from full-term cases. Average levels of organochlorine insecticides, including BHC, aldrin, *p,p'*-DDD (*p,p'*-TDE), *p,p'*-DDT and total OCI estimated in the blood, placenta and fetus showed that those undergoing spontaneous abortions had the highest concentrations. Preterm deliveries contained intermediate concentrations. Full-term labor cases showed the lowest concentrations of these contaminants.

81-1567. Cappon, C. J.; Smith, J. C. (Environ. Health Sci. Cent., Med. Cent., Univ. Rochester, Rochester, NY 14612) **Mercury and selenium content and chemical form in human and animal tissue.** *J. Anal. Toxicol.* 5(2): 90-98; 1981 (61 references).

Selected samples of human and animal tissue were examined by gas chromatography to determine the content, chemical form and distribution of mercury and selenium. In homogenized brain tissue methylmercury accounted for 38.7% of the mercury content. Methylmercury comprised 40.2, 57.0, 39.6, 6.0 and 57.1% of the total mercury content in the human heart, spleen, liver, kidney and placenta, respectively. Of the total mercury found in seal meat, 62.9% was present as methylmercury. The corresponding figure for deer meat was 24.1%. A significant portion of selenium in all samples was present as selenate, averaging 27%. Of the total mercury content in brain, heart and placenta, and in seal liver and meat, 53-80% was water extractable. Only 15-45% of the mercury was extractable from human kidney, liver and spleen, and from deer meat. Inorganic mercury was more extractable than methylmercury, with the exception of human kidney and liver, and deer meat. Of the total selenium, 55-76% was water extractable in all samples with the exception of kidney, liver and deer meat.

81-1568. Adhya, T. K.; Sudhakar-Barik; Sethunathan, N. (Lab. Soil Microbiol., Div. Soil Sci., Cent. Rice Res. Inst., Cuttack 753006, India) **Hydrolysis of selected**

organophosphorus insecticides by two bacteria isolated from flooded soil. *J. Appl. Bacteriol.* 50(1): 167-172; 1981 (9 references).

Rapid hydrolysis of parathion and diazinon (diethyl phosphorothioates) and methyl parathion and fenitrothion (dimethyl phosphorothioates) by a *Flavobacterium* sp. is reported. Also reported is hydrolysis of parathion and diazinon by a *Pseudomonas* sp. The ability of *Pseudomonas* sp. to hydrolyze parathion and diazinon, but not methyl parathion, suggests that the alkyl constituent attached to phosphorus is more important than the aromatic portion in determining the susceptibility of phosphorothioates to bacterial hydrolysis. Growing cells of the *Flavobacterium* sp. hydrolysed all 4 phosphorothioates at the P-O-C linkage with almost equal ease, despite large differences in the alkyl and ring moieties attached to phosphorus. The *Flavobacterium* hydrolyase is concluded to differ from that of the *Pseudomonas* sp. It is suggested that *Flavobacterium* sp. may be particularly useful in developing immobilized enzyme systems for the detoxification of pesticide waste.

81-1569. Pore, R. S.; Sorenson, W. G. (Dep. Microbiol., Sch. Med., West Virginia Univ., Morgantown, WV 26506) **Kepone removal from aqueous solution by immobilized algae.** *J. Environ. Sci. Health A* 16(1): 51-63; 1981 (13 references).

The bioaccumulation of Kepone (chlordecone) by an immobilized form of the achlorophyllous algae, *Prototheca zopfii*, was studied in a model laboratory system using a bioaccumulation column. An aqueous solution containing 1 ppm Kepone was passed through a fixed bed column containing the immobilized algae in agar beads. Kepone was removed from the solution, with about equal efficiency, by immobilized activated charcoal and the immobilized algae. The hydrophobic XAD-2 resin adsorbant was less efficient than these in removal of the pesticide from solution. The removal of Kepone could not be attributed to hydrophobic partitioning; the hydrophobic aflatoxin G1 was not bioaccumulated, and more efficient Kepone bioaccumulation occurred in living than in formalin killed algal cells. No biodegradation of Kepone or aflatoxin by *P. zopfii* was observed.

81-1570. Burnette J. A.; Flick, G. J., Jr.; Ward, D. R.; Young, R. W. (Seafood Process. Res. & Ext. Unit, Dep. Food Sci. & Technol., Virginia Polytech. Inst. & State Univ., Hampton, VA 23669) **Comparison of composition and selected enzyme activities in *Crassostrea virginica* and *Crassostrea gigas*, Eastern and Korean oysters.** *J. Food Prot.* 42(3): 251-255; 1979 (27 references).

Comparisons were made of the composition and activities of certain enzymes of Eastern *(Crassostrea virginica)* and Korean *(C. gigas)* oysters. Proximate analyses, elemental analysis, amino acid and pesticide content determinations, and enzyme analyses were performed. Eastern oysters contained more nitrogen but a lower ash and lipid content, while the amino acid and elemental contents were higher in the Korean species. Lipase activity was higher in the Eastern species, and peroxidase was greater in the Korean species. The pesticides analyzed were chlordane, DDE and other DDTs, malathion, and Perthane; in no case were they present in amounts > 0.1 ppm. PCB levels were also < 0.1 ppm.

81-1571. Forrester, D. J.; Odell, D. K.; Thompson, N. P.; White, J. R. (Lab. Wildl. Dis. Res., Coll. Vet. Med., Univ. Florida, Gainesville, FL 32610) **Morphometrics, parasites, and chlorinated hydrocarbon residues of pygmy killer whales from Florida.** *J. Mammal.* 61(2): 356-360; 1980 (15 references).

Three new records of *Feresa attenuata* (Gray), pygmy killer whale, are reported from Florida with various associated data. Two specimens were males, and one was female. Chlorinated hydrocarbon residues were measured in various whale tissues. In the female whale, ΣDDT in the brain was 3.7 ppm, muscle 2.4 ppm, liver 0.4 ppm, and blubber 4.8 ppm. The same tissues yielded 0.4, 0.6, trace, and 0.8 ppm PCBs, respectively. No traces of dieldrin were found in the female whale. One male specimen was found to be contaminated with 27.1 ppm ΣDDT in the melon, and 23.1 ppm ΣDDT in the intramandibular fat. PCB levels were 76.4 and 79.0 ppm respectively. Trace levels of dieldrin were found in the intramandibular fat. In the third specimen ΣDDT contamination registered 21.1 ppm for the melon, 26.9 ppm intramandibular fat, 2.9 ppm liver, and 0.5 ppm kidney. Similar tissue studies showed 29.0, 36.6, 2.6, and 1.2 ppm concentrations of PCBs, respectively. Traces of dieldrin were found in the melon and kidney.

81-1572. Karapetkova, M. S.; Borisova, E. M. (Author address not given) **Nekotorye khlororganicheskne pestitsidy v zherekhe (*Aspius aspius* L.) bolgarskogo sektora reki Dunaya. [Some organochlorine pesticides in the asp (*Aspius aspius* L.) from the Bulgarian section of the Danube River.]** *Khidrobiologiya* 12: 26-35; 1980 (Bulgarian).

Specimens were taken of the gills, brains, liver, muscle, fat, gonads and intestinal contents of 35 asps, 3 pike-perches and 3 breams. A total of 7 pesticides were detected. The highest concentrations found were those of DDE, followed by lindane. Intermediate concentrations of DDT and TDE were found. Dieldrin, endosulfan and α-BHC demonstrated the lowest concentrations. A trend toward diminishing concentrations of DDT was noted between 1974 and 1976, which was interpreted as an indication of the effectiveness of the ban on DDT usage. Females exhibited higher rates of accumulation due to their higher rates of lipid turnover, growth and feeding. Predators such as the asp and the pike-perch contained higher concentrations than did non-predator species. Residues of lindane, dieldrin and α-BHC were generally below the recommended health hazard levels. Dieldrin in fat samples was above this limit for meat products. DDT and DDE concentrations were also above acceptable levels.

81-1573. Fisyunov, A. V.; Mordovets, A. A.; Nazarenko, A. I. (Agric. Inst., Poltava, USSR) **Osobennosti primeneniya tordona 22K v bor'be s gorchakom polzuchim. [Tordon 22K application against smartweed.]** *Khim. Sel'sk. Khoz.* 19(1): 43-46; 1981 (Russian).

The use of the herbicide Tordon (picloram) and its analog Chloramp against smartweed was studied in maize crop. Chloramp showed weak migration in the soil; 2 mo after application the bulk of herbicide was located in the 0.40 cm soil layer. Chloramp in combination with Banvel D (dicamba) and Polydim had toxic effects on winter wheat and barley in crop rotation. Nine yr after Chloramp application at 1.2 kg/ha, herbicide residues in wheat grain were 0.08 mg/kg.

81-1574. Ambrus, A. (Plant Prot. & Agrochem. Cent., Hungarian Minist. Food & Agric., Budapest, Hungary) **A hazai takarmanyok nuevenyvedoszer- maradek vizsgalati eredmenyei az 1974 – 1978. Evi idoszakban. [Results of the examination of Hungarian feedstuff samples for herbicidal residues between 1974 and 1978.]** *Magy. Allatorv. Lapja* 35(3): 173-176; 1980 (Hungarian).

The results of pesticides residue analyses in feedstuff samples, performed in Hungary during the period 1974-1978, are presented. A total of 939 barley samples were examined for 23 active agents, including aluminum phosphide, diazinon, dichlorvos, lindane, DDT, MCPA and 2,4-D. The levels found exceeded the respective maximum residue levels (MRL) for aluminum phosphide in 1 of 18 samples and for dichlorvos in 3 of 9 samples. The levels were below the detection limit in 853 samples. A total of 2010 wheat samples were investigated for 37 active agents, including aldrin, α-BHC, aluminum phosphide, benomyl, diazinon, diquat, endosulfan, lindane and DDT. Levels exceeding the MRL were found in 296 samples. Levels were below the detection limit in 1344. The residues of 53 active agents, including actinit PK, aldrin, aluminum phosphide, dieldrin, phorate, phosphamidon, phosmet, lindane, DDT and 2,4-D were analyzed in 7666 corn samples. The residue levels exceeded the MRL in 1 case, and were below the detection limit in 500 cases. Residues of 30 active agents, including diquat dibromide, diuron, endosulfan, phencapton, lindane, monocrotophos and paraquat dibromide, were measured in 347 fresh alfalfa samples. The residue levels exceeded the MRL in 3 cases and were below the detection limit in 313 cases. Residue levels exceeding the MRL were found in 4 of 24 dry alfalfa samples, in 25 of 424 sunflower seed samples, and in 2 of 141 soybean samples.

81-1575. Dixon, T. R.; Dixon, T. J. (Sch. Sci. & Environ. Stud., Buckinghamshire Coll. High. Educ., High Wycombe, HP11 2JZ, England) ***Aeolian Sky* packaged chemicals pollution incident.** *Mar. Pollut. Bull.* 12(2): 53-56; 1981 (1 reference).

The *Aeolian Sky*, a cargo vessel which sank off St. Alban's Head in 1979, was loaded with 84 hazardous substances including pesticides, herbicides, disinfectants and general lab chemicals. During the 5 mo after the shipwreck, a total of 3500 packages of chemicals were recovered from a 300 km stretch of shoreline in southern England. During this time 20 persons were hospitalized as a result of contact with opened or leaking chemical packages. No evidence of ecological damage was found. Fishing was prohibited within 1.6 km of the wreck as a precautionary measure. Three sperm whales and 1 pilot whale were found dead on the shore in the affected area; no abnormal levels of chemicals were found in tissue samples taken from these whales, however. Emergency control centers were established in each of the affected counties. Several of the recovered containers were later discovered to have been lost from another shipping accident in the channel. Chemicals recovered from the ship and from the beach areas included > 15,000 kg Gramoxone (paraquat), > 500 kg of Ferosan (thiram), and 8 ℓ of arsenic trichloride.

81-1576. Bertram, H. P. (Inst. Pharmacol. & Toxicol., Univ. Muenster, D-4400 Munster, BRD) **Monitoring inorganic pollutants in domestic and farm animals.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 111-131; 1979 (23 references).

The use of domestic and farm animals in the monitoring of environmental pollutants is discussed. It is pointed out that these animals are of special interest in monitoring pollutants because of their role in the food chain and because, unlike wildlife, domestic and farm animals live in restricted areas, in close contact with human populations. Classification and the establishment of priorities for inorganic pollutants are considered. Sixteen inorganics are reviewed with regard to their entry into the environment, their toxicity, and their background levels in various animals. For instance, methylmercury compounds, used in seed treatment, were found in 1975 in pork chops at 0.03 μg Hg/g. Little is known of the thallium distribution pattern in animals even though it is used as a rodenticide. Farm animal indicator specimens appropriate for each element are proposed. Problems involved in collection, and analytical procedures, are also reviewed.

81-1577. Bromenshenk, J. J. (Dep. Bot., Univ. Montana, Missoula, MT 59812) **Monitoring environmental materials and specimen banking using terrestrial insects with particular reference to inorganic substances and pesticides.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 132-155; 1979 (44 references).

The use of terrestrial insects to monitor en-

vironmental materials, including pesticides, and a proposal for specimen banking are discussed. Insects are convenient and significant to study because of their abundance, species diversity, short life cycles, and ecological importance. Past and current programs involving their use in monitoring are described. The rational for expansion of these programs is that pesticides are hazardous to non-target organisms, including beneficial insects. A brief review is presented of data regarding the known effects of pesticides on insects. Factors involved in the selection of biological specimens for the monitoring of environmental materials are considered, as are sample collection and handling, and analytical procedures. Three functional groups (pollinators, regulators of pest populations, and detritus processors) of terrestrial insects and other invertebrates were identified as particularly well-suited for environmental monitoring and specimen banking.

81-1578. Butler, P. A. (Branch Ecol. Monit., US EPA, Gulf Breeze, FL) **Use of oysters and related molluscs as biological monitors of synthetic organic pollutants.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 156-164; 1979.

The pesticide monitoring program on estuaries in the United States and the use of oysters and related molluscs as biological monitors in this program are discussed. Molluscs are suitable for use as biomonitors because they are filter feeders; ~ 100 gal water are filtered daily, and this allows large samples to be collected within a short time. In addition, data are available on the reactions of oysters to pesticides and other pollutants in the laboratory. During 1965-1972, monthly mollusc samples were collected from about 180 stations, and half of these stations were again monitored in 1977. DDT was found to be essentially ubiquitous; dieldrin was the second most commonly detected pesticide. Residues of endrin, mirex, toxaphene and PCBs were detected only occasionally. It was concluded that pesticide residues in shellfish were not large enough to suggest a human health problem. Details of sample selection and storage, sample processing, organizational aspects of the program, and cost estimates are discussed.

81-1579. Drescher-Kaden, U. (Inst. Physiol. Physiol. Chem. & Ernahrungsphysiol., Fachber. Tiermed., Univ. Munchen, D-8000 Munich, BRD) **Advantage and problems of using wildliving animal species as indicators for environmental pollution (here esp. terrestrial ecosystems).** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 168-183; 1979.

Various aspects of biological monitoring by means of terrestrial wildlife species are discussed. In a discussion of the advantages of using wildlife as biomonitors, it is noted that wildlife species are influenced by the specific food and water supply of their habitat, which can provide evidence of both global contamination and local exposure. Additionally, in some countries these organisms can be used in an early warning system since they are sometimes exposed to banned chemicals. Disadvantages include difficulties in sample collection and in observation of animals in their natural habitat, and lack of knowledge concerning their biology, ecology and behavior. Pilot studies carried out in the Federal Republic of Germany on organochlorine pesticide (OCP) residues in wildlife are described, including details on the selection of suitable specimens. Results indicate that all samples investigated contained ΣOCP residues above the detection limit. Hexachlorobenzene (HCB) and lindane were the most abundant residues in all species studied. DDE was present in most samples, while chlordane, oxychlordane, endrin and α-endosulfan were randomly found, or only of local importance. These results are discussed with regard to correlation between land use and collection sites.

81-1580. Ebing, K. W. (Biol. Bundensanst. Land. & Forstwirtsch., Inst. Pflanzenschutzmittelforsch. D-1000 Berlin 33, BRD) **Monitoring of plants and soil for analysis of possibly hazardous contaminants and banking of these environmental specimens.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 203-210; 1979.

The monitoring of plant materials and soil samples for environmental contaminants and specimen banking of these samples are discussed. Past and current programs are reviewed, and suggestions are provided for future programs. It is suggested that the contaminants to be analyzed should include PCBs and dioxins, chlorophenols and chlorophenoxy-alkane carbonic acid compounds, all fluoro- and several bromo-substituted pesticides and some of their degradation products, and triazine herbicides. Soil is regarded to be the most important matrix. It is suggested that wheat and other commonly used food plants, as well as grass species in areas not used for food plant production, also be sampled. Proposed sampling localities and sample handling are discussed. Recommendations are also made for environmental specimen banking, including organizational aspects, storage technology, legal considerations, and cost estimates.

81-1581. Eckard, R. (Inst. Pharmacol. & Toxicol., Univ. Muenster, D-4400 Munster, BRD) **Non-halogenated organic compounds in aquatic and terrestrial ecosystems.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 211-229; 1979 (54 references).

Monitoring of some non-halogenated compounds (phthalates, nitrosamines, organophosphate pesticides, mycotoxins and antibiotics) in aquatic and terrestrial ecosystems in discussed. Each class of compounds is

discussed with regard to the reason for interest or concern, including metabolic, toxicological and environmental characteristics. Factors affecting sample selection for this monitoring are discussed. It is pointed out that monitoring of organophosphorus pesticides is difficult since specimens which accumulate them are not yet available. The residue concentrations must be sufficiently high (possibly due to local pesticide application) for successful monitoring. Animal tissues are not very useful, but soil and plant samples have been used successfully. Details of sample collection, preservation, storage and analysis are discussed for each class of compounds. Program design, organizational aspects, and cost estimates are included in the review.

81-1582. Fowler, S. W. (Int. Lab. Mar. Radioact., Musee Oceanogr. Monaco, Monaco, Monaco) **Use of macroalgae as a reference material for pollutant monitoring and specimen banking.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Haque): pp. 247-260; 1979 (28 references).

The use of macroalgae as reference materials in marine pollution monitoring studies is discussed. It is strongly recommended that these organisms should be given top priority for use in a tissue bank program. Some of the attributes of macroalgae, which make them appropriate for this program, are that they are ubiquitous in both estuarine and coastal waters throughout the world, are sedentary integrators of many pollutants, and are already in use in many monitoring programs. Details of sample collection and preparation, storage, and analytical procedures are given. It is pointed out that isolated chlorinated hydrocarbons are best analyzed by gas chromatography. Some general guidelines for a program using macroalgae for monitoring are presented, as are cost estimates.

81-1583. Goto, M. (Dep. Chem., Gakushuin Univ., Tokyo 171, Japan) **Monitoring environmental materials and specimen banking. State-of-the-art of Japanese experience and knowledge.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 271-288; 1979 (1 reference).

A description is presented of an environmental survey carried out in 1974-1976 in Japan. Residues of selected chemicals were analyzed in water, sediments and fish at about 50 monitoring stations. The chemicals investigated with phthalic acid esters, organochlorines (DDT, BHC, aldrin, dieldrin), heavy metals, organochlorine solvents (hexachlorobenzene, trichloromethane, trichloroethylene), chlorinated benzenes, and organo-phosphorus compounds. Results are presented in detail in tabular form. The fish of Tokyo and Sagami Bays were found to be contaminated with at least 60 chemicals. The methodologies used in different laboratories were not standardized, therefore the survey produced semi-quantitative results. The results do indicate the complexity of behavior of chemicals in the environment. It is concluded that the prediction of chemical levels in the environment from consumption, biodegradation and bioaccumulation data is difficult. The development of more sophisticated ecotoxicological profiles is recommended.

81-1584. Greve, P. A. (Unit Residue Anal., Natl. Inst. Public Health, Bilthoven, The Netherlands) **Organo-halogenated compounds in aquatic ecosystems.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 289-297; 1979 (87 references).

Monitoring of organohalogenated compounds in aquatic ecosystems is discussed. Past and current programs are reviewed, and the type of information currently available is detailed. Most work has centered on the organochlorine pesticides and PCBs. Data is available for water, sediments, fish and various intermediate organisms in the food chain. Technical, organizational, legal and economic aspects at the proposed monitoring program are considered. It is stressed that water and sediment samples should be analyzed in addition to aquatic organisms. The usefulness of specimen banking is also emphasized.

81-1585. Hapke, H. J. (Abt. Toxikol., Inst. Pharmakol., Tierarztlich. Hochsch., D-3000 Hannover, BRD) **Organo-halogenated compounds in farm and domestic animals.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 313-319; 1979.

A discussion is presented of programs for the monitoring of organo-halogenated compounds (including PCB's, PBB's, DDT, HCH (BHC), dieldrin and heptachlor epoxide) in farm and domestic animals. Past and current programs are discussed, and a proposed specimen bank system is described. Regarding environmental compounds in farm animals, there are two major concerns: the toxicity to the animal, and the presence of the compounds in edible tissues. Concentrations of some of the most important contaminants (DDT, BHC, dieldrin, hexachlorobenzene and heptachlor epoxide) in meats, eggs, and milk are summarized. Program design, sample selection, and details of analytical procedures are among the topics included.

81-1586. Holden, A. (Freshwater Fish. Lab., Pitlechry, Perthshire PH16 5LB, Scotland) **Monitoring environmental materials and specimen banking for organohalogenated compounds in aquatic ecosystems.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N.

P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 320-341; 1979.

The monitoring of organohalogenated compounds in aquatic ecosystems is discussed. Past and current programs are reviewed, and a proposed program is presented. Among the halogenated compounds, the monitoring of organochlorine pesticides (including DDT, aldrin, dieldrin, endrin, heptachlor, hexachlorobenzene, BHC, toxaphene, chlordane and mirex) is important because they can be accumulated from the water by factors of several orders of magnitude due to their high lipid solubility. Few of the current monitoring programs have been designed to provide information over a period of years using a standardized procedure, and little information is available on the existence of long-term specimen banking operations. Considerations such as sample type, choice of species, sample collection, selection of individual specimens, frequency of sampling, and data reporting are discussed with regard to the proposed monitoring program. Organizational aspects, ethical and legal considerations, and cost estimates are also considered.

81-1587. Kemper, F. H. (Inst. Pharmacol. & Toxicol., Univ. Muenster, Munster, BRD) **Experiences in monitoring and banking human biological specimen.** In: *Monitoring Environmental Materials and Specimen Banking.* Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 342-353; 1979 (16 references).

The monitoring of human specimens for organic compounds (such as organochlorine pesticides) and inorganic compounds (such as heavy metals) of toxicological significance is discussed. The use of specimen banking for analysis of trends in exposure to previously unrecognized harmful pollutants is stressed. Sources of human exposure to pesticides are outlined; the total exposure is estimated to be 35 mg/yr. It is suggested that insecticides with a long half-life (DDT, hexachlorobenzene) and substances with possible carcinogenic risk (such as some solvents) should have the highest priority in scientific evaluation. Two monitoring programs currently in use in Germany are described. These are Real Time Monitoring, in which the organochlorine pesticide (OCP) levels in blood and fat samples of living people are measured; and the Environmental Specimen Bank Program, in which the OCP levels are analyzed in various organs of deceased people. In the first program, highest values were found for hexachlorobenzene, and lowest for *o,p'*-DDT. Results obtained in the second program illustrate the influence of some diseases on the distribution and concentration of pesticides in human organs. Similar data are presented for inorganic compounds.

81-1588. Klein, W. (Inst. Ukologische Chem., D-8042 Neuherburg, BRD) **Organohalogenated compounds in plants and soil.** In: *Monitoring Environmental Materials and Specimen Banking.* Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 354-368; 1979 (25 references).

Monitoring of organohalogenated compounds in plants and soil is discussed. Past and current programs are reviewed, and factors relevant to future programs are considered. It is noted that extensive monitoring of organochlorine pesticides has been carried out for several years. A wide range of data has been produced, including the fact that in the United States the average daily intake of DDT has declined, from 0.286 mg/human/day in 1953-1954 to 0.015 mg/human/day in 1970. The need for an internationally coordinated monitoring program for such compounds in soil and plants is stressed, and the importance of specimen banking is illustrated. The effects of storing samples in various types of containers are described. Factors involved in sample selection, containment, and analysis are discussed. Program design, organizational aspects, and cost estimates are also considered.

81-1589. Lewis, R. A.; Lewis, C. W. (Off. Assist. Secr. Environ., US DOE, Frederick, MD) **Terrestrial vertebrate animals as biological monitors of pollution.** In: *Monitoring Environmental Materials and Specimen Banking.* Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 369-391; 1979 (62 references).

The use of terrestrial vertebrate animals as biological monitors of pollution is discussed, with emphasis on the problems of environmental dynamics, ecological sampling, and retrospective evaluation of information. Past and present specimen banking systems are described, and the advantages and special problems of each system are considered. One of the programs described is the National Pesticide Monitoring Program, whose objective is to ascertain on a nationwide scale, independent of specific treatments, the levels and trends of certain pesticidal chemicals and other pollutants in the tissues of selected vertebrate animals. The advantages of using various terrestrial vertebrates for biomonitoring are discussed, as is the feasibility of using specimen banks for retrospective monitoring of environmental pollutants. Specimen banking can compare the present to the past, and predict the future. The cost of specimen banking and the choice of taxa and methods are considered, as are analytical methods.

81-1590. Lowman, F. G. (Environ. Res. Lab., US EPA, Narragansett, RI) **U.S. Mussel Watch Program. The Mussel Watch biological monitoring research program.** In: *Monitoring Environmental Materials and Specimen Banking.* Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 392-396; 1979 (4 references).

A description is presented of the US Mussel Watch Program, in which a total of 107 samples from the 3 major US coasts (Atlantic, Gulf, Pacific) were collected. Samples

were analyzed for heavy metals by flame atomic absorption spectrophotometry, and for petroleum hydrocarbons and halogenated hydrocarbons (including DDT metabolites) by gas chromatography. The results indicate extremely high levels of DDT residues in mussels from the San Pedro-Los Angeles area [17 ppm *p,p'*-DDE and 1.2 ppm *p,p'*-DDD (*p,p'*-TDE)]. Relatively large amounts of PCBs were also seen in this area, and in several other areas. In a description of the program, it is pointed out that the Mussel Watch is not a monitoring program, but rather a monitoring research program, and investigations are underway to work out several of the variables involved.

81-1591. Ludke, J. L. (Columbia Natl. Fish. Res. Lab., US Fish & Wildl. Serv., Columbia, MO 65201) **Collection, storage and analysis of freshwater fish for monitoring environmental contaminants.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 397-402; 1979.

A description is presented of selected aspects of the National Pesticide Monitoring Program, which was begun in 1964. The purpose of the program is to ascertain on a nation-wide basis, and independent of specific treatments, the levels and trends of selected environmental contaminants in the bodies of freshwater fish and certain birds. An historical background of the development of the program is presented. The substances monitored included organochlorine insecticides, polychlorinated biphenyls and heavy metals. Details of sample selection, collection, storage and shipment, and analytical techniques, are discussed.

81-1592. Marty, R.; Boudou, A. (Lab. Anim. Ecol. & Ecophysiol., Bordeaux 1 Univ., F-33405 Bordeaux-Talence, France) **Ecological action of mercury by-products on different animal tissues.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 410-421; 1979 (5 references).

The bioamplification of unbiodegradable toxic products (heavy metals, pesticides, PCBs) in the environment is considered. An ecotoxicological model in the freshwater environment was developed. The development of the model involved creation of an experimental trophic chain; selection of species characteristic of different trophic levels in nature that were compatible with breeding in the laboratory; control of abiotic factors; definition of experimental conditions; and choice of a toxic product with which quantitative evaluation of low levels, approaching those in natural systems, was possible. The food chain established was *Chlorella vulgaris* → *Daphnia magna* → *Gambusia affinis* → *Salmo gairdneri* → *Esox lucius*←↑. Food chain studies which assess the impact of mercury by-products (mercuric chloride and CH_3HgCl) on various tissues were conducted. Effects of mercury in aquatic ecosystems, use of natural and artificial food chains, *in situ* studies, experimental models to assess ecological effects, and program design are discussed. Mercury by-products at 1 ppb were added to the water. Light and electron microscopic studies were carried out, and mercury was analyzed in various tissues. Light microscopic examination of liver fragments indicate the main effects to be the appearance of intracellular vacuoles and the tendency to make bile thrombi similar to what is observed in human retentional and blood proteins, and analysis of mercury by-product action on cellular membranes.

81-1593. Moriarty, F. (Monks Wood Exp. Stn., I.T.E., Nat. Environ. Res. Counc., Abbots Ripton, Huntingdon PE17 2LS, England) **Organo-halogenated compounds in terrestrial wildlife.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 422-429; 1979 (7 references).

The use of terrestrial wildlife to monitor organo-halogenated compounds is discussed. No such programs are currently in existence; a proposed program is described. It is noted that the major reason for concern regarding organo-halogenated compounds is their high degree of persistence. These compounds have 3 distinct patterns of release into the environment: pesticides are released deliberately; many compounds, such as fluorocarbons and chloroform, inevitably find their way into the environment; and PCB release often occurs by negligence. Sample selection, techniques for obtaining and storing samples, analytical methods, program design and cost estimates for the monitoring program are discussed. Factors which should be considered in development of any pilot program include species range and type; persistence aspects; pollutant levels; timing and type of samples; avoiding artefacts, contamination, postmortem changes and interference from other compounds; confirmation of analytical identifications; and the nature of sampling errors.

81-1594. Murton, R. K. (Inst. Terr. Ecol., Monks Wood Exp. Stn., Huntingdon, England) **Considerations applicable to the monitoring of organo-halogenated compounds in terrestrial wildlife, especially birds.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 450-469; 1979 (42 references).

The use of birds to monitor organo-halogenated compounds is discussed, and a monitoring system in existence in England since 1962 is described in detail. Dead birds of prey have been analyzed for organo-halogen residues in an attempt to police the efficacy of various agreements introduced to limit the use of the more toxic insecticides. Eggs of terrestrial birds have also been used for monitoring. The substances of concern are DDT and its metabolites, HCH (BHC), cyclodienes (aldrin, dieldrin,

heptachlor, chlordane), PCBs, and polychlorinated terphenyls. Sample collection and storage, analytical procedures, program design, and organizational aspects are discussed, along with some results that have been obtained. The various pesticides analyzed have been shown to peak at various months of the year, and the statistics used in analyzing these differences are discussed in detail.

81-1595. Musick, J. (Inst. Mar. Sci., Gloucester Point, VA 23062) **The role of deep-sea organisms in monitoring environmental xenobiotics.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 470-478; 1979 (30 references).

The use of deep sea ecosystems to provide baseline data on the extent of worldwide distribution of xenobiotics, and to provide an index of atmospheric and oceanic processes of degradation and accumulation is discussed. A description of deep-sea environments is given, and potential xenobiotic transport routes (which closely parallel energy pathways) are considered. Specifically, transport of organic halogens and heavy metals from the land, through the atmosphere, and into oceans is described. One model suggests that DDT residues occurred at maximum concentrations in the air in 1966 and in the mixed layer of the ocean in 1971. A 1975 study in the Gulf of Mexico revealed the presence of DDT and its metabolites in small quantities in most fish and in some zooplankton samples. Dieldrin occurrence was more sporadic, but in higher concentrations. Regarding deep-sea monitoring, a pilot tissue-banking program is discussed, along with methods for collection, transportation and storage of materials.

81-1596. Ohlendorf, H. M. (Patuxent Wildl. Res. Cent., US Fish & Wildl. Serv., Laurel MD 20811) **Archiving wildlife specimens for future analysis.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijoff Publ.: The Hague): pp. 491-504; 1979 (45 references).

Tissue banking of wildlife specimens (specifically birds, bird parts, and eggs) for future analysis is described. Past and current programs are reviewed. The analysis of duck wings and starlings as part of the National Pesticide Monitoring Program is discussed in detail. Duck wings were determined to be appropriate for monitoring, since DDT residues in wings are highly correlated with residues in other tissues. Starlings were chosen for study because their omnivorous food habits are expected to reflect the general environmental presence of persistent pesticides and certain heavy metals. Other animals that have been studied are the bald eagle and the brown pelican. It is noted that the current programs are valid and useful, but the further step of tissue archives would allow re-analysis when analytical techniques are improved, or new pollutants are recognized. The rationale for interest or concern in various compounds is discussed. It is concluded that organochlorine pesticides are of great concern in birds. Factors involving sample selection, collection and storage, analytical procedures, program design, organizational aspects, ethical and legal considerations, and cost estimates for a monitoring program are discussed.

81-1597. Ravera, O. (Dep. Phys. & Nat. Sci., Comm. Comunita Eur., Centro Comune Ric., I-21020 Ispra (Varese), Italy) **Pollution effects in freshwater communities.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 521-535; 1979 (36 references).

A review is presented of the effects of pollution in freshwater communities. Pollutants can be divided into categories on the basis of their chemical or physical characteristics or their use; currently no satisfactory classification on the basis of toxicity exists. A general discussion is presented of the range of biological effects of pollution and problems regarding the choice of species for toxicity testing. Important uses of biological monitoring of pollutants and several common methods for monitoring in freshwater are described. It is concluded that the best method for monitoring and controlling the freshwater environment is a study carried out in different seasons in one or more compartments of the community. A discussion is also presented of criteria for evaluating acceptable risk involving various pollutants.

81-1598. Ichinose, H.; Akaeda, H.; Kumani, M.; Kurihara, S. (Nagasaki Prefect. Inst. Publ. Health & Environ. Sci., Nagasaki, Japan) **[Pesticide residues in foods. Report No. 10.]** *Nagasaki-ken Eisei Kogai Kenkyusho-ho (Annu. Rep. Nagasaki Prefect. Inst. Public Health Environ. Sci.)* 20: 153-155; 1979 (3 references) (Japanese).

Pesticide residues in 90 vegetable, fruit and potato samples, 30 meat samples, 10 egg samples and 10 raw milk samples produced in Nagasaki Prefecture in 1979 were examined. Vegetables, fruits and potatoes contained not detectable (ND) to 0.003 ppm BHC, except for 1 case of 0.006 ppm BHC. Dieldrin was detected in potatoes only, at a mean level of 0.001 ppm. Malathion, dichlorvos and *o*-sec-butylphenyl methylcarbamate (BPMC) were not detected in meats, eggs or milk. In 10 commercial milk samples, an average of 0.002 ppm α-BHC, 0.002 ppm β-BHC, 0.003 ppm ΣBHC, 0.001 ppm *p,p'*-DDE, 0.002 ppm ΣDDT and 0.001 ppm dieldrin were detected. Maximum values were 0.003, 0.007, 0.010, 0.005, 0.007 and 0.005 ppm, respectively. In 2 cases, 0.002 and 0.001 ppm *p,p'*-DDD (*p,p'*-TDE) were detected and in 2 cases, 0.001 and 0.002 ppm heptachlor epoxide were detected. The detection limits for malathion, dichlorvos and BPMC of the adopted analysis methods were 0.005, 0.02 and 0.005 ppm, respectively.

81-1599. Duinker, J. C.; Hillebrand, M. T. J. (The Netherlands Inst. Sea Res., Texel, The Netherlands) **Behavior of PCB, pentachlorobenzene, hexachlorobenzene, α-HCH, β-HCH, γ-HCH, dieldrin, endrin and *p,p'*-DDD in the Rhine-Meuse estuary and the adjacent coastal area.** *Neth. J. Sea Res.* 13(2): 256-281; 1979 (28 references).

A study was conducted to determine the distribution of several organochlorines in the region of the Rhine-Meuse estuary. A series of sampling stations was established in both the estuary and its contributing rivers in 1974, 1976, and 1979. Bottom sediment, interstitial and surface water, and seston samples were collected. Organochlorines were identified by GLC with electron capture detection. Dissolved pentachlorobenzene, hexachlorobenzene (HCB) and PCBs were lower in the estuarine region. In river water, PCB was equally distributed between solution and as suspended particulates. Pentachlorobenzene, HCB and the HCH (BHC) compounds were primarily in solution and were the main compounds observed in the rivers. Dieldrin, endrin and DDD (TDE) were generally in concentrations below detection limits in the rivers. Concentrations of all compounds were salinity dependent. Large volume water samples were collected in the estuary. The concentrations of penta- and hexachlorobenzene were 0.1 ng/l; PCB, 0.7 ng/l; γ-HCH (lindane), 0.9 ng/l; α-HCH, 1.0 ng/l; β-HCH, 0.04 ng/l; dieldrin, 0.1 ng/l; and endrin and DDD, < 0.01 ng/l.

81-1600. Goldberg, E. D. (Chem. Dep., Geol. Res. Div., Scripps Inst. Oceanogr., La Jolla, CA) **The oceans as waste space: the argument.** *Oceanus* 24(1): 2-9; 1981 (11 references).

Various toxic substances have been located in the ocean waters including synthetic organic chemicals such as DDT and PCBs, the oxidation products from chlorination and ozonation of waste and cooling waters, artificial radionuclides, biostimulants, microorganisms, trace metals, fossil fuel compounds and dredged materials along with large-volume wastes such as sewage sludges and industrial discards. Different methods of surveillance have been employed to keep abreast of the situation including the use of bivalves to monitor the environmental levels of halogenated hydrocarbons, petroleum hydrocarbons, atrificial radionuclides, and heavy metals. Preliminary models have been constructed using existing data so that the assimilative capacities of various marine waters can be ascertained. Presently work is underway to determine the impact of pollutants on the marine biosphere.

81-1601. Kamlet, K. S. (Off. Pollut. & Toxic Subst., Natl. Wildl. Fed., Washington, DC) **The oceans as waste space: the rebuttal.** *Oceanus* 24(1): 10-17; 1981 (12 references).

The author argues against the use of the ocean as a dumping ground for refuse. Experimental studies that have been conducted strongly suggest that there will be adverse effects in the ocean and the general environment through dumping of waste into the oceans of the world. It is hard to identify specific effects, however, due to the wide varieties found in this portion of the environment. The author urges the development of new and more reliable field tests of chronic effects as a constructive step. However, it is suggested that a cautious approach must be maintained when dealing with toxic substances. Regulation standards must be based on projections from lab experiments and mass balance models.

81-1602. Mearns, A. J. (NOAA, Seattle, WA) **Ecological effects of ocean sewage outfalls: observations and lessons.** *Oceanus* 24(1): 45-54; 1981 (10 references).

Municipal sewage from large cities such as Los Angeles and San Diego contain not only diluted mixtures of fecal material, urine, pulverized food, water, and by-products from garbage disposal units, but also measurable amounts of potentially toxic chemicals used in the home and industry. Among these are synthetic, halogenated (mostly chlorinated), hydrocarbons. Recently concentrations and mass emission rates of several dozen types of materials discharged into Southern California coastal waters have been monitored. A partial quantification of the concentrations of a variety of volatile and semi-volatile organic solvents and related halogen derivatives has been achieved. Air (smog) is the dominant source of lead and DDT and PCBs. The effects of the outfalls on physical and aesthetic conditions of the water, water chemistry, and plankton are considered. Concentrations of trace elements and DDT in muscle tissue of 7 seafood organisms from the Palos Verdes shelf collected between 1975-76 are given. Residues of DDT, in intertidal biota along the coast and in pelicans and other seabirds at island breeding colonies 100 km away, confirms that toxic materials from discharges can enter the upper pelagic zone and be transported to distant sites.

81-1603. Chopade, H. M.; Dauterman, W. C.; Simoneaux, B. J. (Toxicol. Program, Dep. Entomol., North Carolina State Univ., Raleigh, NC 27650) **Studies on residues and the metabolic pathway of methidathion in tomato fruit.** *Pestic. Sci.* 12(1): 17-26; 1981 (11 references).

The residues and metabolism of methidathion [*S*-(2,3-dihydro- 5-methoxy-2-oxo- 1,3,4-thiadiazol- 3-ylmethyl) *O,O*-dimethyl phosphorodithioate] and its secondary metabolites: demethyl-methidathion [*S*-(2,3-dihydro-5-methoxy-2-oxo- 1,3,4-thiadiazol- 3-ylmethyl) *O*-methyl *O*-hydrogen phosphorodithioate] (IV), the sulfide (2,3-dihydro-5- methoxy-3-methylthiomethyl- 1,3,4-thiadiazol- 2-one) (I), the sulfoxide (2,3-dihydro-5- methoxy-3-methylsulfinylmethyl- 1,3,4-thiadiazol-2-one) (II) and the sulfone

(2,3-dihydro-5- methoxy-3-methylsulfonylmethyl- 1,3,4-thiadiazol- 2-one) (III) were studied in laboratory-treated tomato fruit. The metabolites and residues of methidathion were determined for the applied doses of 1, 7 and 14 mg methidathion/kg fruit. Methidathion was metabolized extensively over a 14-day period. The amount of metabolites formed was a function of both the applied dose as well as the time after application. Major water-soluble metabolites were found to be IV and the cysteine conjugate (VI). The chloroform-soluble metabolites were identified as the oxygen analog of methidathion [*S*-(2,3-dihydro-5-methoxy-2-oxo- 1,3,4-thiadiazol- 3-ylmethyl) *O,O*-dimethyl phosphosothioate] (V), the sulfoxide (II), and the hydroxy compound 2,3-dihydro-3-hydroxymethyl- 5-methoxy-1,3,4-thiadiazol-2-one. The oxygen analog of methidathion (V) was found in small amounts, corresponding to < 5% of the added methidathion. Demethyl-methidathion (IV) appeared to be a precursor in the formation of the cysteine conjugate (VI). The sulfide (I) seemed to be more reactive in forming the cysteine conjugate than the sulfoxide (II) or the sulfone (III). (Author abstract by permission)

81-1604. Burkhard, N.; Guth, J. A. (Agric. Div., Ciba-Geigy Ltd., Basel, Switzerland) **Rate of volatilisation of pesticides from soil surfaces: comparison of calculated results with those determined in a laboratory model system.** *Pestic. Sci.* 12(1): 37-44; 1981 (6 references).

A laboratory model system for the determination of the volatility of non-ionic pesticides from soil surfaces is presented. The pesticides examined were the insecticides methidathion, diazinon, and isazophos, the herbicide metolachlor, and the fungicide metalaxyl. The rates of volatilization of these compounds from soil increased with increasing pesticide concentration, temperature and air flow rate and with decreasing soil organic matter content. The volatilities of the same pesticides were also calculated by using their vapor pressure, water solubility and soil adsorption data. The excellent correlation between calculated and experimental results showed that information on the volatility of a chemical can be obtained simply by calculation. Such calculations allow the classification of each pesticide according to its volatility, and therefore represent a useful alternative for volatility studies in laboratory model systems. (Author abstract by permission)

81-1605. Burkhard, N.; Guth, J. A. (Agric. Div., Ciba-Geigy Ltd., Basel, Switzerland) **Chemical hydrolysis of 2-chloro-4,6-bis(alkylamino) -1,3,5-triazine herbicides and their breakdown in soil under the influence of adsorption.** *Pestic. Sci.* 12(1): 45-52; 1981 (12 references).

The determination of rate constants and the calculation of the activation parameters [activation energy, free energy of activation and entropy of activation] demonstrated the identity of the reaction kinetics of chemical hydrolysis of the chlorinated triazine herbicides simazine, atrazine, propazine and terbuthylazine. Persistence in soil could be estimated from the hydrolytic half-life time only in pH regions where these compounds were also sensitive to chemical hydrolysis. In general, the rate of hydrolysis increased in the presence of soil as the result of a catalyzing effect of the soil in their breakdown. When half-lives in soil of these triazine herbicides were compared with adsorption constants, a functional relationship was observed in both soil types; as adsorption increased the half-life in soil also increased. (Author abstract by permission)

81-1606. Shanker, J.; Srivastava, U. C. (Dep. Chem., C.M.P. Degree Coll., Allahabad 211002, India) **Effect of pesticides on extractibility of soil-iron: system 1: aldicarb.** *Pesticides* 14(10): 16-21; 1980 (11 references).

Studies were designed to determine the effect of the systemic pesticide aldicarb (Temik 10G) on the extractability of soil-iron. Soil samples at 3 different moisture levels were treated with iron as ferrous ammonium sulfate, aldicarb at 3 concentrations, or iron + aldicarb. After a 10 day incubation period, soil samples were extracted with acetic acid, citric acid or potassium nitrate. Ferric ion was estimated in the extracts colorimetrically. The data indicate a maximum release of iron of about 17% in a citric acid extract for the 5 mg dosage of aldicarb under unsaturated moisture conditions. Acetic acid and potassium nitrate effect practically no release of soil-iron. The available of soil-iron was promoted by aldicarb by 6.7% in water extracts and 12.3% in citric acid extracts. However, this promotion was inhibited by the presence of ferrous ammonium sulfate. A probable mechanism for these observations is proposed in terms of Fe(II), Fe(III) binding to aldicarb metabolites. Estimates of percent Fe II - Fe III change in soil are also made.

81-1607. Yoneda, M.; Takeshita, T.; Inuyama, Y.; Soda, T.; Saito, K. (Shimane Prefect. Inst. Public Health & Environ. Sci., Matsue, Shimane, Japan) **[Environment polluting substances in daily diet.]** *Shimane-ken Eisei Kogai Kenkyusho-ho (Annu. Rep. Shimane Prefect. Inst. Public Health Environ. Sci.)* 21: 85-90; 1979 (1 reference) (Japanese).

A total diet study of 89 different food products (rice, beans, cereals and potatoes, carbohydrates, fats and oils, fruits, green vegetables, root vegetables, beverages and spices, fish and shellfish, eggs and meat, dairy products, prepared meals, and water) obtained from local markets in Shimane Prefecture was conducted. The food samples were assembled by food groups and prepared for consumption. The samples were then analyzed for heavy metal and organochlorine and organophosphorus pesticide contamination. Daily intake of the various contaminants was determined for individual food groups and for the total diet. Total daily intake was 3.66 μg ΣBHC, 4.02 μg ΣDDT, 0.82 μg hexachlorobenzene, 13.11 μg mercury, 0.30

μg dieldrin, and 0.38 μg heptachlor epoxide. EPN, diazinon, dimethoate, malathion, parathion, methyl parathion, aldrin, endrin, and heptachlor were not detected in any of the samples.

81-1608. Soda, T.; Takeshita, T.; Inuyama, Y.; Yoneda, M.; Inuyama, Y.; Goto, M. (Shimane Prefect. Inst. Public Health & Environ. Sci., Matsue, Shimane, Japan) **[Investigation of environment polluting substances in foods.]** *Shimane-ken Eisei Kogai Kenkyusho-ho (Annu. Rep. Shimane Prefect. Inst. Public Health Environ. Sci.)* 21: 91-95; 1979 (Japanese).

BHC, DDT, dieldrin, endrin, diazinon, EPN, malathion, parathion, and fenitrothion residues were investigated in 32 samples of agricultural crops, 22 milk samples, 10 samples of fish, and 2 eggs. Captafol, chlorobenzilate, dicofol, dichlorvos, chlorfenvinphos, fenthion, and phenthoate residues were also determined in a smaller number of specimens. BHC was detected in 25 crops samples, and in all samples of milk, fish and eggs. DDT was detected in 5 crop samples, and in all samples of milk, fish and eggs. Dieldrin was detected in 3 crop samples, in 7 fish samples, and in all milk and egg specimens. No crop contained pesticide residues at higher levels than allowable standards. It was observed that fish are relatively highly contaminated with pesticides.

81-1609. Inuyama, Y.; Soda, T. (Shimane Prefect. Inst. Public Health & Environ. Sci., Matsue, Shimane, Japan) **[Investigation on residues of fenitrothion due to aerial application for controlling Japanese pine sawyer.]** *Shimane-ken Eisei Kogai Kenkyusho-ho (Annu. Rep. Shimane Prefect. Inst. Public Health Environ. Sci.)* 21: 96; 1979 (2 references) (Japanese).

Fenitrothion residues in rivers, a swimming pool, and an eel-breeding pond were investigated after a diluted formulation of fenitrothion was applied from a helicopter twice, in June 1979, at 30 ℓ/ha. Water specimens from 3 rivers were taken before, and on days 0, 3, 5, and 6 after application. Water samples from other locations were taken before and on the day of application. River water concentrations ranged from trace (TR) to 0.0006 ppm before the first application; from TR to 0.00007 ppm 6 days later; from 0.00005 to 0.0072 ppm before the second application; and from TR to 0.00018 ppm 6 days later. Water from a swimming pool and an eel-breeding pond was also collected and concentrations of fenithrothion ranged from 0.00022 ppm before the first application to 0.00789 ppm just after the second application.

81-1610. Stralka, K. A.; Camper, N. D. (Dep. Microbiol., Clemson Univ., Clemson, SC 29631) **Microbial degradation of profluralin.** *Soil Biol. Biochem.* 13(1): 33-38; 1981 (19 references).

Investigations were carried out on the degradation of profluralin by soil microorganisms, including identification of some of the degraders and the degradation products formed. The microorganisms that could degrade profluralin were isolated using a selective culture technique combined with autoradiography. The most active degraders were tentatively identified as *Arthrobacter simplex*, *Cellulomonas flavigenum*, and *Microbacterium flavum*. Thin layer chromatography and scintillation methodology were used to measure profluralin degradation. It was determined that steps in the degradation pathway involve dealkylation of the amino nitrogen and reduction of at least one of the nitro groups. Co-metabolic processes were apparently involved, and exogenous carbon and nitrogen were required for degradation.

81-1611. Ferriss, R. S.; Mitchell, D. J. (Dep. Plant Pathol., Univ. Kentucky, Lexington KY 40546) **Population dynamics of soil microorganisms associated with fungicide-dusted caladium seedpieces.** *Soil Biol. Biochem.* 13(1): 57-63; 1981 (17 references).

Studies were conducted to determine the effects of captan; benomyl + thiram + streptomycin sulfate (benomyl mixture); and chloroneb + thiram + streptomycin sulfate (chloroneb mixture), on the population dynamics of soil microorganisms. Caladium corms were cut into seedpieces (germinating and decomposing), and dusted with 1 of the 3 treatments. The seedpieces were then planted in muck soils from areas of stunted plants associated with high populations of *Pythium* spp. and *Fusarium* spp. Controls received no fungicides. Microbial populations around the seedpieces were analyzed at 0, 2, 4, 8 and 12 wk after planting. Higher populations occured around the control decomposing seedpieces than around the germinating seedpieces. The fungicide dusts reduced the rate of increase of the total population of fungi on the germinating seedpieces. However, the fungal populations on decomposing seedpieces were not affected by the fungicides. Increased bacteria levels on the decomposing seedpieces were prolonged by the fungicides. Bacterial growth was unaffected by fungicides on the germinating seedpieces.

81-1612. Miyazaki, T.; Akiyama, K.; Kaneko, S.; Horii, S.; Yamagishi, T.; Murakami, H. (Tokyo Metrop. Res. Lab. Public Health, Tokyo, Japan) **[Identification and determination of chlordanes and their closely related compounds in fish and shellfish.]** *Tokyo Toritsu Eisei Kenkyusho Kenkyo Nempo (Annu. Rep. Tokyo Metrop. Res. Lab. Public Health)* 31(1): 161-165; 1980 (8 references) (Japanese).

Fish and shellfish samples, collected from Tokyo Bay in August 1978, were examined for total chlordane and individual chlordane isomers (oxychlordane,

trans-chlordane, *cis*-chlordane, *trans*-nonachlor, *cis*-nonachlor). The samples were analyzed by gas chromatography with electron capture detection after they had been cleaned up on a Florisil column to remove DDE and PCB interference. Total chlordane levels were 18 ppb in goby, 14 ppb in gray mullet, 39 ppb in sea bass, 60 ppb in oysters, 16 ppb in blue mussel, 4.6 ppb in surf clam and 19 ppb in ark shell. Oxychlordane levels were highest in sea bass, *trans*-chlordane, *cis*-chlordane and *trans*-nonachlor levels were highest in oyster. *Cis*-nonachlor levels were highest in goby.

81-1613. Koseki, M.; Shimamura, Y.; Maki, T.; Tamura, Y.; Naoi, Y. (Tokyo Metrop. Res. Lab. Public Health, Tokyo, Japan) **[Residues of chlorothalonil, captan, diazinon and quinomethionate in vegetables and fruits.]** *Tokyo Toritsu Eisei Kenkyusho Kenkyo Nempo (Annu. Rep. Tokyo Metrop. Res. Lab. Public Health)* 31(1): 170-173; 1980 (7 references) (Japanese).

Samples of spinach, cabbage, Chinese cabbage, cucumber, tomatoes, apples, pears, peaches, and strawberries were collected in Tokyo and analyzed for fungicide residues. Quinomethionate was only determined in strawberries and no residues were detected. Captan was not detected in any of the fruits or vegetables. Diazinon levels ranged from trace (TR) to 0.03 ppm in peaches and was not detected in the other samples. Chlorothalonil residues were found in almost all samples; levels ranged from 0.001 to 1.35 ppm. Allowable concentrations of chlorothalonil are 1.0 ppm.

81-1614. Ushio, F.; Doguchi, M.; Fukano, S.; Abe, M. (Tokyo Metrop. Res. Lab. Public Health, Tokyo, Japan) **[Polychloroterphenyl, polychlorobiphenyl and residues of BHC and DDT in crows and pigeons.]** *Tokyo Toritsu Eisei Kenkyusho Kenkyo Nempo (Annu. Rep. Tokyo Metrop. Res. Lab. Public Health)* 31(1): 209-211; 1980 (12 references) (Japanese).

Residues of polychlorinated terphenyls, polychlorinated biphenyls, DDT and its degradation products, and BHC isomers were investigated in 34 crows captured in Tochigi and Tokyo Prefectures in 1976, and in 15 pigeons captured in Tokyo and Kanagawa Prefectures in 1973. DDE in the adipose tissues of pigeons ranged from 0.6 to 12.3 ppm. The 3 highest values (3.8, 8.7 and 12.3 ppm) were found in pigeons from Kanagawa Prefecture. Maximum levels of β-BHC, ΣBHC, DDE and ΣDDT in adipose tissues of 26 crows captured in metropolitan Tokyo were 3.1, 3.4, 14.0 and 20.0 ppm, respectively. In liver these values were 2.1, 2.3, 6.8 and 11.0 ppm for β-BHC, ΣBHC, DDE and ΣDDT, respectively. β-BHC, ΣBHC, DDE and ΣDDT, levels in livers of 8 crows captured in Kanagawa Prefecture were 9.2, 9.8, 8.5 and 8.9 ppm, respectively.

81-1615. Hills, D. J.; Curley, R. G.; Knutson, J. D.; Seiber, J. N.; Winterlin, W. L.; Rauschkolb, R. S.; Pullman, G. S.; Elmore, C. L. (Bot. Dep., Univ. California, Davis, CA) **Composting treatment for cotton gin trash fines.** *Trans. ASAE* 24(1): 14-19; 1981 (15 references).

Studies were carried out to evaluate composting as a means of disposing of cotton gin trash, with emphasis on the ability of this method to degrade pesticide residues, *Verticillium dehliae*, and weed seeds in the fines (the fine, non-lint fraction). Gin trash fines were composted in six 0.5 m^3, pilot model composters, and investigations were carried out to establish an optimum compositing procedure. In the second phase of the study, the presence of three types of weed seeds and the wilt organism *V. dahliae* were determined, and samples were removed periodically and assayed for DEF, Kelthane (dicofol), and paraquat. The composting process required approximately 5 wk before weed seeds and *V. dahliae* were degraded. DEF and paraquat were not degraded; Kelthane was slightly degraded; reductions of ~ 23% occurred. The composted material appeared to exhibit no phytotoxicity to sorghum when applied at 44.8 t/ha.

81-1616. Holleman, J. W.; Ryon, M. G.; Hammons, A. S. (Oak Ridge Natl., Lab., Oak Ridge, TN) **Chemical contaminants in non-occupationally exposed US residents.** *US NTIS PB Rep.* PB80-192,339: 152 pp.; 1980 (622 references).

The report reviews the manner in which chemical contaminants found in non-occupationally exposed US residents enter the environment and subsequently human tissue. Approximately 100 contaminants are treated. Sources of literature used in the survey covered a 30-yr period, the bulk of which was published within the past decade. Contaminants discussed include organochlorine, organophosphorus, carbonate, and miscellaneous pesticides; PCBs and PBBs and terphenyls; halogen compounds; asbestos; and heavy metals. Production; use; entry into the environment; entry, metabolism, and effects in humans; and description and evaluation of methods of analysis and validity of the data are the chief aspects treated. For pesticides, indiscriminate use is the chief means of environmental entry. Entry into humans is by ingestion of particulate residues or through foods, particularly fat-containing animal products. Sources of environmental entry for metals and other elements are burning of fossil fuels, industrial operations, dissipative uses, and natural inputs. Entry in humans occurs largely by exposure to airborne particulates, and to a lesser degree through food and water. Some elements are essential or beneficial at one level of concentration and toxic at another. Discussion of the status of elements from this standpoint are included where appropriate. (Author abstract by permission)

81-1617. Zharasov, Sh. U. (Kazakh Res. Inst. Plant Prot., Alma Ata, USSR) **Deistvie gerbitsidov na**

mikrofloru i biologicheskuyu aktivnost' yuzhnykh pochv Kazakhstana. [Effect of herbicides on the microflora and biological activity of soils of southern Kazakshstan.] *Vestn. Skh. Nauki Kaz.* 22(5): 37-39; 1979 (Russian).

The effect of the herbicides 2,4-D, its amine salt, and 2M-4CP (mecoprop) on soil microflora and biological activity of the soil was studied. The herbicides did not inhibit the number of nitrogen-fixing bacteria, but did reduce the number of phytopathogenic fungi. Herbicides stimulated growth of *Azotobacter* and cellulose-degrading bacteria. The activities of soil protease, phosphatase and invertase were not altered.

81-1618. Sotiriou, N.; Klein, W.; Korte, F. (Inst. Okol. Chem., Ges. Strahlen & Umweltforsch. mbH Muenchen, D-8042 Neuherberg, BRD) **Einfluss von Stickstoffduengung auf die Umwandlung von Mondinuron-(Phenyl-^{14}C) in Boden und Seine Aufnahme durch hoehere Pflanzen unter Freilendbedingungen. [Effects of nitrogen fertilizer on the fate of monolinuron in the soil plant system.]** *Z. Pflanzeneraehr. Bodenkd.* 143(2): 200-207; 1980 (20 references).

The effect of nitrogen fertilization (50 and 100 kg/ha urea N) on the residue levels of ^{14}C-monolinuron (2.5 kg/ha) in potato and winter barley plants and in soil was studied in pot tests. Nitrogen fertilization had practically no effect on radioactivity uptake by the plants. Residue concentrations were lower in treated plants due to increased crop yields (dilution effect). The total radioactivity corresponding to the intact substances and its metabolites in the soil, especially in the upper 20 cm layer, was, however, higher in the treated pots (by 8% at 50 kg/ha and by 18% at 100 kg/ha) during the first 2 yr. This was suggested to be due to the increased formation of polar metabolites and to the binding of monolinuron and its metabolites to the biomass (reduced evaporation) as a result of intensified microbial activity in the presence of N.

See also 81-1502, 81-1507, 81-1513, 81-1517, 81-1526, 81-1527, 81-1528, 81-1529, 81-1530, 81-1538, 81-1539, 81-1541, 81-1619, 81-1622, 81-1623, 81-1626, 81-1627, 81-1628, 81-1632, 81-1633, 81-1635, 81-1639, 81-1653, 81-1654, 81-1657, 81-1658, 81-1663, 81-1666, 81-1669, 81-1693, 81-1723, 81-1725, 81-1726, 81-1771, 81-1778, 81-1779, 81-1783, 81-1784, 81-1786, 81-1794, 81-1797 *and* 81-1798.

81-1619. Kloke, A.; Oberman, H. (Fed. Cent. Plant Pathol. & Plant Prot., Berlin, BRD) **Harmful effects of environmental chemicals on agricultural and horticultural production in peri-urban areas and their impact on land use planning.** *Agric. Plann. Manage. Peri-Urban Areas* 2: 213-233; 1975 (17 references).

A discussion is presented of air pollution and its ramifications on land use planning. The current emissions in the Federal Republic of Germany are described, in particular those from industry, motor traffic, and residential areas. The spreading of these emissions and the factors affecting their transport by air are considered. Various computations indicate that in Germany a maximum of 7% of the agricultural production area and its products may be affected by air pollutants. A discussion is also presented of the laws protecting humans, animals, and plants against environmental chemicals, particularly pesticides and heavy metals, in the Federal Republic of Germany. With regard to land use, it is concluded that in polluted, peri-urban areas, food plants that can be easily contaminated and that are consumed without technical processing should not be cultivated. German food legislation prohibits trade of agricultural products which have been exposed to levels of contaminants that result in residues hazardous to human health. Further legislation in this area will be enacted, if necessary, to prevent residues from exceeding tolerable maximums.

81-1620. Sandifer, S. H.; Cupp, C. M.; Wilkins, R. T.; Loadholt, B.; Schuman, S. H. (Prev. Med. Div., Med. Univ. South Carolina, Charleston, SC 29401) **A case-control study of persons with elevated blood levels of dieldrin.** *Arch. Environ. Contam. Toxicol.* 10(1): 35-45; 1981 (12 references).

Twenty-seven pesticide workers with elevated blood levels of dieldrin ($\geq$ 15 ppb) were involved in a case-control study which included history and physical examination, comprehensive neurological evaluation, laboratory tests, and psychological and psychomotor testing. No clinically important differences were found on history, physical, specialized neurological tests, or laboratory examination. The exposed group showed a statistically significant difference in 5 out of 58 psychological (P) and psychomotor (PM) tests – at least 3 would be expected by chance ($p \leq 0.05$). In only one of these tests was there any significant correlation with dieldrin levels. Even though the exposed group had worse scores than the control group in 47 of 58 P-PM tests, such scores were, with a few exceptions, in the normal range of values. Elevated blood levels of dieldrin encountered in this study do not appear to have any chronic deleterious effects on health, as measured by conventional medical work-up and extensive central nervous system testing. (Author abstract by permission)

81-1621. Pazderova-Vejlupkova, J.; Nemcova, M.; Pickova, J.; Jirasek, L.; Lukas, E. (Fac. Gen. Med., Charles Univ., Prague, Czechoslovakia) **The development and prognosis of chronic intoxication by tetrachlorodibenzo-*p*-dioxin in men.** *Arch. Environ. Health* 36(1): 5-11; 1981 (9 references).

During 1965 to 1968, 80 workers who had been engaged in the production of 2,4,5-sodium trichlorphenoxyacetate and butylester of trichlorphenoxyacetate acid (2,4,5-T) became ill. The cause of the illness was 2,4,7,8-tetrachlorodibenzo-*p*-dioxin. A 10-yr study has been conducted for 55 exposed individuals. The majority of the patients developed chloracne, and 11 manifested porphyria cutanea tarda. Approximately 50% of the patients suffered from metabolic disturbances, i.e., pathologically elevated lipids with abnormalities in the lipoprotein spectrum, and 40% of the patients had pathological changes in the glucose tolerance test. One-third of the patients had biochemical deviations indicative of a mild liver lesion. Histological examination revealed light steatosis, or periportal fibrosis, or activation of Kupffer cells. Fluorescence of the liver tissues was present in ultraviolet light. In 17 persons, symptoms of nervous system focal damage existed, with predominance of peripheral neuron lesion of the lower extremities (verified by EMG examination). The majority of patients suffered from various psychological disorders. As of this date, 2 patients have died of bronchogenic lung carcinoma; one of liver cirrhosis; 1 of a rapidly developed, extremely unusual type of atherosclerosis precipue cerebri; and 2 patients have died in traffic accidents. The conditions of most other patients have improved. (Author abstract by permission)

81-1622. Holiday, A. D.; Hardin, D. P. (Fertilizer/Agric. Chem. Div., Farmland Ind. Inc., Kansas City, MO 64116) **Activated carbon removes pesticides from wastewater.** *Chem. Eng. (NY)* 88(6): 88-89; 1981.

A wastewater treatment system is described that uses activated carbon in treating an industrial wastewater stream containing a number of pesticides, including phenoxy, organophosphorus, and organochlorine compounds. The overall system provides feedwater conditioning or pre-treatment and guards against possible releases of contaminated water. Adsorption columns allows parallel flow for processing the water at twice the series flow rate. The system currently processes 300,000 gal of water/yr (1268.04 kℓ/yr). To date, over 110,000 gal (464.948 kℓ) of wastewater have been processed. Overall removal efficiency has been $\geq$ 99% for 2,4-D esters, terbufos, phorate, chlordimeform, carbaryl, atrazine, and metolachlor. For malathion, carbon adsorption has been only 98.3% efficient.

81-1623. Anonymous **Weighing benefits against risks.** *Crops Soils* 33(6): 8-10; 1981.

In general, farmers have been among the first to recognize the economic and environmental advantages of

alternatives to routine pesticide applications. Integrated pest management, including biological and other natural pest control techniques, is being used more frequently in farming with greater success for a wider variety of crops. Synthetic pyrethroids have also been used to a large degree lately. These have an increased level of specificity, sparing many of the beneficial insects which were previously destroyed along with the harmful ones during applications of broad spectrum insecticides. Costs involved in registration of pesticides are briefly discussed. Among those exposed to pesticides through their occupations, farmers are second only to pesticide plant workers in exposure amounts. However, pesticide plant workers have suffered fewer pesticide-related hospitalizations than farmers.

81-1624. Anonymous **Statement on regulation of chemical carcinogens.** *Environ. Int.* 3(6): 443-457; 1980 (15 references).

The Regulatory Council was established in 1978 to coordinate the regulatory activities of various government agencies. The policy statement of the Regulatory Council, based on previous efforts by the EPA, FDA, OSHA and Consumer Product Safety Commission, is presented. Four major areas related to the regulation of chemical carcinogens are considered. Determination of whether a chemical may be a carcinogen involves epidemiological studies, testing in animals, short-term screening tests, and efficient testing policy. Assessment of carcinogenic risk to humans requires analysis of carcinogenicity and human exposure data. Risk assessment precepts followed by regulatory agencies are outlined. Priorities for regulation of carcinogens must be established; criteria for establishing these priorities are presented. Regulatory action is then made based on risk, technical and economic feasibility, and/or comparison of costs and benefits. Principles followed by regulatory agencies are summarized. Federal agencies having primary roles in the regulation of chemical carcinogens are described. The Environmental Protection Agency (EPA) regulates the release of potential carcinogens into air and water, their disposal as solid or liquid wastes, and their uses in pesticides. The statutes defining the responsibilities of the EPA are listed, including the Federal Insecticide, Fungicide and Rodenticide Act. Scientific bases for the identification of potential carcinogens and risk, and interagency coordination efforts, are also discussed.

81-1625. Miller, S. (Author address not given) **Environmental health issues.** *Environ. Sci. Technol.* 15(3): 248-249; 1981.

The means of assessing hazardous chemicals and the resulting regulatory actions are discussed. It is noted that short-term testing procedures are inexpensive and rapid. Although some methods have been used before being properly validated, others, like the Ames mutagenicity test, are widely used and extensively validated. There are several unsolved issues, at present, for which regulatory agencies should conduct testing. In the meantime, these agencies could be greatly aided by information on which chemicals pose the greatest hazard to humans. The Ames test appears to be very useful in this regard. A valuable result of this test is the determination of the daily dose that results in tumors in 50% of a test population (TD50). It is predicted that eventually over 600 chemicals will be assessed. The TD50 of chemicals that have aroused public concern, such as DDT, dioxin, benzene, saccharin, benzo(a)pyrene, vinyl chloride, ethylene dibromide, and ethylene dichloride, need to be evaluated.

81-1626. Antonovich, E. A.; Gumennyi, V. S. (All-Union Res. Inst. Hyg. & Toxicol. Pestic. Polym. & Plast., Kiev, USSR) **O sovershenstvovanii podkhodov k otsenke vrednosti i opasnosti pestitsidov i razrabotke gigienicheskikh reglamentov. [Perfecting an approach for determining the danger and risk of pesticides and developing hygienic standards.]** *Gig. Sanit.* 45(1): 15-18; 1980 (10 references) (Russian).

A number of new proposals are suggested to increase the efficiency of evaluations made to determine the toxicological effects of pesticides and to establish standards to govern their safe use. Several chemicals, such as dithiocarbamates and organophosphorus compounds, are cited specifically. The need for studying pesticide metabolism in the biosphere is stressed and is linked to the study of pesticide behavior in foodstuffs during their manufacture, canning and preparation. Factors which determine the structure of pesticide residues in food are reviewed.

81-1627. Shtannikov, E. V.; Eliseev, Yu. Yu. (Med. Inst., Saratov, USSR) **Izuchenie effektiviosti ochistki vody na model'nykh bodoprovodnykh ochistnykh sooruzheniyakh ot priduktov transformatsii fosfororganicheskikh pestitsidov. [Efficiency of water purification from transformation products of organophosphorus pesticides as assessed in model water treatment plants.]** *Gig. Sanit.* 45(12): 6-9; 1980 (Russian).

The efficacy of existing systems of water purification for removing organophosphorus pesticides (OPP) transformation products was tested. Conventional methods of water purification failed to reduce the odor of OPP-containing water. Experiments in rats and mice showed that the products of OPP-transformation were more toxic than the parent compounds: carbophos (malathion) inhibited cholinesterase activity by 67.1% compared to 80% inhibition produced by its chlorination products. The use of activated charcoal reduced the toxicity of water containing OPP transformation products and improved the organoleptic properties of water.

81-1628. Tsapko, V. G.; Os'kuna, V. N. (Res. Inst. Ind. Hyg. & Occup. Dis., Kiev, USSR) **Gigienicheskaya kharakteristika primeneniya pestitsidov i mineral'nykh udobrenii pri vozdelybanii sakharnoi svekly. [Hygienic characteristics of the use of pesticides and mineral fertilizers in sugar beet crop.]** *Gig. Sanit.* 46(1): 64-65; 1981 (4 references) (Russian).

Evaluations of the working conditions during applications of pesticides and mineral fertilizers to sugar beet fields are reported. It was found that concentrations of pesticides, dust, and carbon monoxide in the air of the working zones were significantly greater than the respective maximum permissible values (MPL). Applications of metaphos (methyl parathion) at 1.2 kg/ha, bazudin (diazinon) at 1.0 kg/ha, and betanol (phenmedipham) at 1-7 kg/ha did not cause residue levels to exceed the MPL in the working zone of the tractor drivers. However levels of γ-HCH (lindane), applied at 0.9 kg/ha, were 0.5 mg/m³ and levels of tillam (pebulate), applied at 4 kg/ha, were 1.0 mg/m³. In the respiratory zone of planters, rogor (dimethoate) and γ-HCH (in isolated cases) levels exceeded the MPL. Analysis of morbidity in 100 tractor drivers over a 3 yr period showed that respiratory diseases, central nervous system pathologies, and diseases of the locomotor apparatus were dominant.

81-1629. Trauberman, J. (Author address not given) **Compensating victims of toxic substances pollution: an analysis of existing federal statutes.** *Harv. Environ. Law Rev.* 5(1): 1-29; 1981 (249 references).

The federal statutes pertaining to the compensation of victims of toxic substance exposure are reviewed. The government recognizes 3 types of damage: injuries to health, pecuniary damages and resource contamination. Elimination of the cause of damage is a major problem. The basic approaches to causation are discussed. Social security disability insurance, medicare, and medicaid (which do not require proof of causation), the Federal Employer's Liability Act, the Federal Longshoremen's and Harbor Workers Compensation Act, the Price-Anderson Act, the Federal Water Pollution Control Act, and Veteran's Compensation (which require proof of causation) are described and analyzed. An issue in Veteran's Compensation is exposure to the herbicide Agent Orange (2,4-D and 2,4,5-T) in Vietnam. The Veteran's Administration has indicated that compensation will only be granted for a condition known as chloracne, since there is no firm data which implicates the herbicide as a causative agent of any known category of disease or chronic symptom in humans. Statutes which impose collective liability, including Black Lung program and oil pollution compensation statutes, are also discussed.

81-1630. Turner, A. (Author address not given) **Food and public safety.** *Inst. Food Sci. Technol. Proc.* 13(4): 235-250; 1980 (17 references).

Of the various possible hazards to humans from food consumption, possible contamination of that food by pesticide residues ranks lower on the list of hazards than foodborne infection, nutritional hazards, environmental contamination and natural toxicants. The only listed hazard of less concern than pesticide residues are food additives. It is suggested that this low hazard rating for pesticide residues has resulted from efforts on their evaluation and legislative control. A food safety decision tree model is described for use in determining the safety of foods, food additives and food contaminants.

81-1631. Brassow, H. L.; Baumann, K.; Lehnert, G. (Ordinar. Arbeitsmed., Univ. Hamburg, D-2000 Hamburg 76, BRD) **Occupational exposure to hexachlorocyclohexane. II. Health conditions of chronically exposed workers.** *Int. Arch. Occup. Environ. Health* 48(1): 81-87; 1981 (13 references).

A discussion of the health conditions of workers chronically exposed to hexachlorocyclohexane (BHC) is presented. Sixty male workers, 24-62-yr-old, from the lindane production department of a chemical factory and 20 male clerks of the same age distribution were examined. No signs of increased morbidity in the chemical worker group could be ascertained. No specific pathologic signs were observed during physical examination. However, increased reticulocytes and polymorphonuclear leukocytes and decreased lymphocyte counts were observed in the chemical worker group. Lower prothrombin times and lower blood concentrations of creatinine and uric acid were also observed in the exposed group. No other blood parameters were significantly different between the controls and exposed group. Continued monitoring of the health of lindane production workers is recommended.

81-1632. Spear, R. C. (Dep. Biomed. Environ. Health Sci., Sch. Public Health, Univ. California, Berkeley, CA 94720) **Technical problems in determining safe re-entry intervals.** *J. Environ. Pathol. Toxicol.* 4(5-6): 293-304; 1980 (16 references).

Evidence is cited to support the suggestion that responsible agencies move to review the strategy for the protection of field workers from overexposure to pesticide residues. The current re-entry concept is designed to prohibit the entry of the worker into the field, after pesticides have been applied, until a safe level of pesticide residue remains. The interval of waiting varies with the type of pesticide used, amount of pesticide applied, particular crops in question, and other factors. While these re-entry standards were set in 1971, it was not until 1973 that a method existed for measuring the residue specifically relevant to workers and their exposure. The 4 processes which link pesticide application to human toxicity include residue decay, exposure, absorption and body response. Recently

obtained knowledge of residue decay and exposure processes are briefly described. It is suggested that in situations where a toxic residue is dislodged from the foliage of a crop and carried to the field workers on dust particles, it may be possible to estimate pesticide exposure from data concerning pesticide residues on the dust. Examination of methods recently advanced to determine the parameters of the absorption process as a function of the particular pesticide and the anatomical site of exposure is recommended. It is suggested that if these approaches yield information concerning the absorbed dose and its time course of action, then a simple animal model to estimate the relative cholinesterase inhibiting potency of a particular organophosphate should be forthcoming.

81-1633. Semanayake, N.; Jeyaratnam, J. (Dep. Med., Fac. Med., Univ. Peradeniya, Peradeniya, Sri Lanka) **Toxic polyneuropathy due to gingili oil contaminated with tri-cresyl phosphate affecting adolescent girls in Sri Lanka.** *Lancet* 1(8211): 88-89; 1981 (5 references).

An epidemiological outbreak of acute polyneuropathy due to tri-cresyl phosphate (TCP) poisoning in over 20 women in Sri Lanka during 1977-78 is discussed. The case histories of two girls, aged 15 and 17, are presented as representative of the course of illness. The girls presented at the hospital with pain in the calves, followed by weakness of the feet and hands, bilateral foot drop, bilateral claw hands, wrist drop and absent ankle jerks. The women affected were 14-17-yr-old and had attained menarch 2-4 wk before illness developed. Due to local customs and traditions, it was determined that ingestion of contaminated gingili oil was the cause of the outbreak. Samples of the oil from manufacturers and wholesale dealers and from two homes were obtained for analysis. As much as 5600 μg/g were detected in the samples. Some samples also contained traces of malathion (0.4-5.8 μg/g). The pesticide residue was thought to be present due to treatment of the gingili plants. The TCP contamination appeared to have resulted from storage of the oil in barrels previously used for transporting mineral oil.

81-1634. Greenwald, E. D.; Greenwald, E. S.; Brenner, S. M. (Inst. Environ. Med., Med. Cent., New York Univ., New York, NY) **Extrahepatic bile duct cancer.** *N. Y. State J. Med.* 81(3): 324-326; 1981 (23 references).

Upon noting an increased incidence of extrahepatic bile duct cancer at Montefiore Hospital and Medical Center, an investigation was undertaken to determine the cause. The number of cases seen at this hospital over the past several years increased from 7 before 1960, to 12 during 1965-1970, and to 19 from 1976 through 1979. After a thorough literature review it was concluded that environmental factors have caused the increased incidence, and that further epidemiologic investigation is warrented. A study of carcinogenic and mutagenic activity in the bile of cancer patients compared to controls without malignant disease is suggested. The best diagnostic technique at present is a transhepatic cholangiogram which allows the physician to collect bile for study without added risk to the patient. Bile could also safely be collected from patients who have abdominal surgery for benign conditions and comparisons between the 2 could be made. Chemicals suggested for further investigation include the pesticide aramite.

81-1635. van Rensburg, J. F. J.; Hassett, A.; Theron, S.; Wiechers, S. G. (Natl. Inst. Water Res., Counc. Sci. & Ind. Res., Pretoria 0001, South Africa) **The fate of organic micropollutants through an integrated wastewater treatment/water reclamation system.** *Prog. Water Technol.* 13(1): 537-552; 1981 (20 references).

Results obtained on a pilot scale, integrated wastewater treatment/water reclamation system in Pretoria, South Africa, are presented. The presence in the finished water of volatile halogenated hydrocarbons, chlorinated hydrocarbons, chlorophenols, polynuclear aromatic hydrocarbons, phenolic compounds, and other compounds was investigated. The results were compared to results from other water treatment facilities in South Africa. The quality of the final water obtained through this integrated wastewater treatment/water reclamation system was comparable or superior to potable water supplies in 3 South Africa cities, and also superior to the final effluent produced by a non-integrated water reclamation plant with activated sludge effluent as feedwater. Wastewater was also inoculated with 19 organic compounds representative of common hazardous organic wastewater pollutants to evaluate the ability of the plant to remove these substances. Compounds used for inoculation included endosulfan, α-BHC, dieldrin, chlorfenvinphos, dichlorobenzene, atrazine, phenol, chlorophenol, trichlorophenol, pentachlorophenol (PCP), naphthalene and dichlorvos. Denitrification resulted in removal of up to 80% for 12 of the 19 compounds (average removal = 37%). Chemical clarification removed up to 85% for 15 of the compounds (average = 35%). A combination of nitrification pond and biological clarification removed up to 100% (average = 69%) for 16 compounds. Pre-chlorination, roughing and dual media filtration, active carbon adsorption, final chlorination, and the effect of shock loads were also evaluated. Levels of all inoculated compound were reduced to below hazard limits. A multiple barrier effect is suggested.

81-1636. Wargo, J. J. (Int. Sanit. Supp. Assoc., Chicago, IL) **Pesticide marketing law. Part I.** *Soap Cosmet. Chem. Spec.* 57(2): 54-5-54-5; 1981.

The four basic anti-trust laws that govern the marketing of pesticide products are noted and briefly discussed. These include the Sherman Act of 1890, the

Clayton Act of 1914, the Robinson-Patman Act of 1936 and the Federal Trade Commission Act of 1914. Various aspects of pesticide pricing are considered in light of legal restrictions.

See also 81-1502, 81-1507, 81-1508, 81-1511, 81-1512, 81-1513, 81-1523, 81-1526, 81-1527, 81-1529, 81-1530, 81-1539, 81-1541, 81-1562, 81-1563, 81-1569, 81-1575, 81-1587, 81-1616, 81-1660, 81-1663, 81-1665, 81-1769, 81-1771 *and* 81-1772.

81-1637. Srivastava, A. K.; Singh, N. N. (Dep. Zool., Univ. Gorakhpur, Gorakhpur 273001, India) **Effects of acute exposure to methyl parathion on carbohydrate metabolism of Indian catfish *(Heteropneustes fossilis).*** *Acta Pharmacol. Toxicol.* 48(1): 26-31; 1981 (43 references).

Work carried out to determine effects of acute exposure to a high sublethal concentration of methyl parathion on a number of carbohydrate metabolites in freshwater Indian catfish is reported. Muscle and liver glycogen, blood glucose, lactate, and pyruvate levels were measured at 3, 6, 12, 48 and 96 hr after exposure. The control concentration of muscle glycogen averaged 0.38 mg/100 mg wet wt of tissue. Pesticide exposure reduced this concentration at 3, 6, 12 and 96 hr. The mean concentration of blood glucose in controls was 47.43 mg/100 ml. Blood glucose was significantly elevated at 3 and 6 hr after exposure to methyl parathion; the value at 6 hr exhibited a 3-fold increase over controls. The concentration of pyruvate at 3 and 48 hr was not affected in exposed fish. Blood lactate levels increased significantly at 3 hr from mean control levels of 20.92 mg/100 ml by exposure to methyl parathion. Significant decreases in lactate values were noted at 48 and 96 hr. Fish demonstrated rapid swimming following by tetanic immobility and extension of the pectoral fins forward to the limit before dying.

81-1638. Muecke, W.; Kriemler, H. P.; Hug, P.; Alt, K. O. (Agric. Div., Ciba-Geigy Ltd., CH-4002 Basel, Switzerland) **Metabolism of *O,O*-dipropyl *S*-(2-(2′-methyl-′-piperdinyl)-2-exo-ethyl) *S*-(2-(2′-methyl-1′ piperidinyl)-2-oxo- ethyl) phosphorodithioate (C 19 490) in the rat.** *Agric. Biol. Chem.* 45(1): 43-51; 1981 (19 references).

The fate of C 19 490 (piperophos), an active ingredient of the herbicides Rilof and Avirosan, was investigated in rats using 2-methyl [^{14}C]-labeled material. After single oral doses (0.5-30 mg/kg body wt) the radioactivity was rapidly excreted, mainly through urine. Nine days after receiving a dose of 5.4 mg/kg, the residues in liver, fat, kidney, muscle, blood and brain were below 0.03 ppm C 19 490 equivalents. Thirteen urine metabolites, representing 55% of the dose applied, were isolated and their structures elucidated by spectroscopic methods. The degradation of C 19 490 in the rat proceeds via hydrolysis of the thiolo phosphate followed by methylation of the sulfhydryl group. The methylthio derivative is either oxidized at the sulfur or hydroxylated at the piperidine moiety. Hydroxylation at the α-C leads, via ring opening, to carboxylic acids. The hydroxypiperidine derivatives are conjugated with glucuronic acid. No unchanged C 19 490 was excreted with the urine and the amount of $^{14}CO_2$ expired was below 0.5% of the dose. (Author abstract by permission)

81-1639. Mayer, D. F.; Johansen, C. A.; Eves, J. D.; Britt, R.; Bergin, D. (Coll. Agric., Washington State Univ., Prosser, WA 99350) **Monitoring of honey bee mortality from insecticides.** *Am. Bee J.* 120(5): 352-355; 1980 (5 references).

A honey bee monitoring program was initiated in 1979 as part of the Washington Cooperative Extension Integrated Pest Management Project. Twenty-eight apiaries were monitored in Central Washington; 13 in the Yakima Valley, 13 in the Columbia Basin, and 2 in the Kittitas Valley. Up to 79% of the sample colonies suffered 1 bee kill, while 11% suffered more than 6 kills. More bee poisonings occurred in the Yakima Valley than in the other 2 areas. Mortality was low in 87% of the incidents, moderate in 10% and high in 3%. An apron-type trap was used as the monitoring tool, since it was easily and inexpensively constructed as well as fairly effective. The traps were only 50.6% effective due to acclimation of the bees to the trap.

81-1640. LaPlante, J. R. (Author address not given) **Arizona Valley beekeepers stung badly by hive losses tied to pesticides.** *Am. Bee J.* 120(5): 391-392; 1980.

Several beekeepers in the Mesa and West Phoenix area have suffered large bee kills since nearby alfalfa fields were sprayed with Penncap, an encapsulated pesticide containing methyl parathion. Penncap is toxic to bees according to the label on the containers, but is not predicted to be a problem when sprayed before the alfalfa has bloomed. The fields this year were sprayed early to combat wild mustard and other weeds. Because the capsules are the size of pollen grains bees pick them up during foraging in the alfalfa fields and carry then back to the hives. Estimated losses to the beekeepers from the 300 destroyed hives are $40,000. Samples from the hives are being analyzed to determine pesticide content.

81-1641. Hunter, G. S.; Prahlad, K. V.* (Dep. Biol. Sci., North. Illinois Univ., DeKalb, IL 60115) **The effects of paraquat on neonatal rat lung: a histological and biochemical study.** *Arch. Environ. Contam. Toxicol.* 10(1): 151-158; 1981 (25 references).

The effects of paraquat on morphological, histological, and biochemical parameters in neonatal rat liver were studied. One-day-old rat pups were injected (IP) with 25 mg paraquat/kg body wt and sacrificed after 24 hr. At the end of the experimental period, the body wt in control and herbicide-treated animals slightly increased and decreased, respectively. The lung wt in the paraquat group was not significantly lower than in the control. Histologically, the lungs from the paraquat group showed an increase in the thickness of the alveolar wall with much intra-alveolar infiltration of cells and cell debris. In the paraquat-treated group, while the total lung protein increased by about 18%, the enzyme phosphatidic acid phosphatase activity was reduced nearly 30%. These results indicate that paraquat induces both histological and

biochemical changes in the neonatal rat lung. (Author abstract by permission)

81-1642. Jonsson, H. T., Jr.; Walker, E. M., Jr.; Grenne, W. B.; Hughson, M. D.; Hennigar, G. R. (Dep. Biochem., Med. Univ. South Carolina, Charleston, SC 29403) **Effects of prolonged exposure to dietary DDT and PCB on rat liver morphology.** *Arch. Environ. Contam. Toxicol.* 10(2): 171-183; 1981 (27 references).

Livers from mature female rats exposed for up to 36 wk to dietary levels of Aroclor 1242 (75 or 150 ppm) and/or commercial grade DDT (75 or 150 ppm) were compared to those from animals receiving basal diets. In earlier studies, reproductive effects of the test substances were assessed. Moreover, the markedly abnormal gross appearance of the livers led to examination of the hepatic effects of PCB and DDT in more detail, at both the light microscope (LM) and electron microscope (EM) levels. Light microscopy revealed focal liver cell necrosis in rats fed PCB, DDT, and PCB-DDT combinations. Higher levels of PCB (150 ppm) increased the severity of necrosis. Feeding both DDT and PCB produced similar effects at 75 ppm, and caused atypical centrolobular regeneration, occasionally forming nodules resembling small tumors. The experimentally induced injury was associated with the marked accumulation of iron-containing pigment in hepatocytes and Kupffer cells. Electron micrographs demonstrated the presence of whorl structures (myelin figures) within liver cell cytoplasm, and for the first time clearly illustrated the endocytotic expulsion of these membranous whorls from hepatocytes into the bile canaliculi and sinusoids. Other ultrastructural changes were similar to those previously reported in rat livers injured by several hepatotoxic substances. Mitochondria enclosed by, or projecting into, large non-lipid vacuoles were present in several experimental groups. The electron micrographs provide the most convincing evidence to date to support the hypothesis that myelin figures may be the vehicle whereby the cell rids itself of specific hepatotoxic substances. (Author abstract by permission)

81-1643. Zinkl, J. G.; Roberts, R. B.; Shea, P. J.; Lasmanis, J. (Dep. Clin. Pathol., Sch. Vet. Med., Univ. California, Davis, CA 95616) **Toxicity of acephate and methamidophos to dark-eyed juncos.** *Arch. Environ. Contam. Toxicol.* 10(2): 185-192; 1981 (9 references).

The calculated, acute oral LD50 of acephate and methamidophos to dark-eyed juncos *(Junco hyemalis)* was 106 mg/kg and 8 mg/kg, respectively. Brain cholinesterase (ChE) activity in birds that died after acephate poisoning was depressed 80% below that of control birds. Birds that died of acute methamidophos poisoning had brain ChE depression of 60%. The birds killed by acephate had brain acephate residue concentrations > 2 mg/kg and methamidophos concentrations usually > 0.25 mg/kg. Eighty percent of the birds killed with methamidophos had brain methamidophos concentrations > 0.1 mg/kg. The 5-day feeding LC50 for acephate was 1485 mg/kg. Brain ChE activities of birds which died early in the study were less depressed (51.5%) than those which died at a later date (69.6%). Brain residues of acephate and methamidophos were lower in these birds than in the birds of the acute oral LD50 studies. Brain ChE activity returned to normal within 3 days after the birds received a single sublethal dose of acephate. These studies indicate that the amount of acephate needed to produce the ChE depression, found in other investigations in most dark-eyed juncos exposed to forest applications of insecticide, is about 20% of the LD50; however, in a few birds the ChE activity may be depressed to near lethal levels. (Author abstract by permission)

81-1644. Fleming, W. J. (Patuxent Wildl. Res. Cent., Fish & Wildl. Serv., US Dep. Inter., Laurel, MD 20811) **Recovery of brain and plasma cholinesterase activities in ducklings exposed to organophosphorus pesticides.** *Arch. Environ. Contam. Toxicol.* 10(2): 215-229; 1981 (31 references).

Brain and plasma cholinesterase (ChE) activities were determined for mallard ducklings *(Anas platyrhynchos)* exposed to dicrotophos and fenthion. Recovery rates of brain ChE did not differ between ducklings administered a single oral dose *vs.* a 2-wk dietary dose of these organophosphates. Exposure to the organophosphates, followed by recovery of brain ChE, did not significantly affect the degree of brain ChE inhibition or the recovery of ChE activity at a subsequent exposure. Recovery of brain ChE activity followed the general model $Y = a + b(\log X)$ with rapid recovery to about 50% of normal, followed by a slower rate of recovery until normal ChE activity levels were attained. Fenthion and dicrotophos-inhibited brain ChE were only slightly reactivated *in vitro* by pyridine-2-aldoxime methiodide, which suggested that spontaneous reactivation was not a primary method of recovery of ChE activity. Recovery of brain ChE activity can be modeled for interpretation of sublethal inhibition of brain ChE activities in wild birds following environmental applications of organophosphates. Plasma ChE activity is inferior to brain ChE activity for environmental monitoring, because of its rapid recovery and large degree of variation among individuals. (Author abstract by permission)

81-1645. Hill, R. H.; Rollen, Z. J.; Kimbrough, R. D.; Groce, D. F.; Needham, L. L. (Cent. Dis. Control, Public Health Serv., US Dep. Health & Hum. Serv., Atlanta, GA) **Tetrachloroazobenzene in 3,4-dichloroaniline and its herbicidal derivatives: propanil, diuron, linuron, and neburon.** *Arch. Environ. Health* 36(1): 11-14; 1981 (11 references).

The presence of 3,3',4,4'-tetrachlorobenzene (TCAB) was determined by high performance liquid chromatography in 3,4-dichloroaniline and herbicides made therefrom (propanil, diuron, linuron and neburon). The concentrations of TCAB in 3,4-dichloroanilines and in different herbicides from a variety of manufacturers ranged from 9 to 1400 μg/g (ppm). The chloracnegenic potential of these products, as determined by rabbit ear test, suggests that it is in the same range of 2,3,7,8-tetrachlorodibenzodioxin, a known potent chloracnegenic agent. (Author abstract by permission)

81-1646. Leck, J. B.; Park, B. K. (Dep. Pharmacol., Univ. Liverpool, Liverpool L69 3BX, England) **A comparative study of the effects of warfarin and brodifacoum on the relationship between vitamin K_1 metabolism and clotting factor activity in warfarin-susceptible and warfarin-resistant rats.** *Biochem. Pharmacol.* 30(2): 123-128; 1981 (16 references).

The effects of the anticoagulants warfarin and brodifacoum on [^{3}H]vitamin K_1 metabolism and clotting factor activity were studied in warfarin-susceptible and warfarin-resistant rats. Brodifacoum produced the same rate of degradation of prothrombin complex activity (PCA) as warfarin in the rat and significantly reduced the activity of clotting factors, II, VII, IX and X but did not affect factor V. Metabolic studies using [^{3}H]vitamin K_1 showed that brodifacoum increased the hepatic concentration ratio of [^{3}H]vitamin K_1 epoxide: [^{3}H]vitamin K_1 in both warfarin-susceptible and warfarin-resistant rats at doses which produced anticoagulation. Brodifacoum produced a significant increase in the rate of excretion of [^{3}H]vitamin K_1 metabolites in bile but did not affect the urinary excretion of [^{3}H]vitamin K_1 metabolites. The results indicate that brodifacoum has the same mechanism of action as warfarin and support the concept that coumarin anticoagulants reduce vitamin K_1-dependent clotting factor synthesis by interrupting the vitamin K_1-epoxide cycle. (Author abstract by permission)

81-1647. Brigelius, R.; Hashem, A.; Lengfelder, E. (Inst. Pharmakol. Toxikol. & Pharm., Fachber. Tiermedizin, Univ. Muenchen, D-8000 Munich 22, BRD) **Paraquat-induced alterations of phospholipids and GSSG-release in the isolated perfused rat liver, and the effect of SOD-active copper complexes.** *Biochem. Pharmacol.* 30(4): 349-354; 1981 (29 references).

The possibility that generation of active oxygen species and lipid peroxidation are involved in paraquat toxicity was examined through the use of the superoxide dismutase-active, low molecular weight copper complexes $Cu(tyr)_2$ and Cu-penicillamine. In addition, it was investigated whether the oxidation of glutathione is directly associated with paraquat-induced lipid peroxidation. An increase in diene adsorption and a decrease in phospholipids of mitochondria and microsomes isolated after perfusion of rat livers with paraquat could be observed. These effects may be explained by lipid peroxidation. $Cu(tyr)_2$ abolished these effects of paraquat. In contrast, the increase of GSSG-release into the perfusate upon paraquat-treatment could not be influenced by Cu-penicillamine, and was only partially inhibited by $Cu(tyr)_2$. Therefore the GSSG-release cannot be the result of paraquat-induced generation of O_2^- or lipid peroxidation and seems more likely to be caused by the NADPH depleting action of paraquat. It is proposed that the alterations suggesting lipid peroxidation may only be observed if hepatic glutathione content decreased below a critical value. (Author abstract by permission)

81-1648. Kraus, P.; Gross, B.; Kloft, H. D. (Inst. Toxikol. & Pharmakol., Philipps-Univ. Marburg, D-3550 Marburg, BRD) **The elevation of rat liver glutathione-*S*-transferase activity by alpha-hexachlorocyclohexane.** *Biochem. Pharmacol.* 30(4): 355-361; 1981 (31 references).

Single ip dose (30-200 mg/kg) of α-hexachlorocyclohexane (α-BHC) elevated the activity of glutathione-*S*-transferases for 1,2-dichloro-4-nitrobenzene and 3,4,5,6 pentachlorocyclohex-1-ene in rat liver cytosol by 50-60%. The activity for 1,2-epoxy-3-(p-nitrophenoxy)-propane remained unchanged. Under similar conditions, the activity of mitochondrial glutathione-*S*- transferases was also elevated, the activity of the microsomal enzyme was not. Single po dose (200 mg/kg) of α-hexachlorocyclohexane had only little effect on the hepatic, and no effect on the intestinal glutathione-*S*-transferases. Oral application of 0.2-1.0 mg/kg of α-hexachlorocyclohexane daily for 41 days had no effect on hepatic glutathione-*S*- transferases. The inducibility of glutathione-*S*- transferases by α-hexachlorocyclohexane changed during the development. The activity of cytosolic glutathione-*S*- transferases was also elevated by α-hexachlorocyclohexane (γ-BHC, lindane) and 3,4,6/5-pentachlorocyclohex-1-ene. (Author abstract by permission)

81-1649. Pipy, B.; Gaillard, D.; Derache, R. (Groupe Rech. Toxicol. Aliments & Boissons, INSERM U-87, Toulouse, France) **Phagocytic activity of the reticuloendothelial system in the rat and rates of *in vivo* excretion of metabolites of carbaryl and *in vitro* microsomal metabolism.** *Biochem. Pharmacol.* 30(6): 669-672; 1981 (27 references).

The biliary, urinary and pulmonary excretion of ^{14}C-labeled metabolites were measured *in vivo* after the administration of ^{14}C-carbaryl to rats. Rat reticuloendothelial systems (RES) were either inhibited by colloidal carbon or activated by glyceryl trioleate. The *in vitro* N-demethylation of carbaryl and 3 other mixed function oxidase activities were also evaluated in animals that received

similar treatment. The results indicated that the colloidal carbon, which inhibits RES activity and the liver microsomal metabolism, equally decreased the excretion capacity of ^{14}C-labeled carbaryl metabolites by the liver and increased urinary excretion. Glyceryl trioleate decreased the liver microsomal metabolism; the hepatic excretion of the metabolites remained unchanged, and increased in the urine and expired air.

81-1650. Luk'yanov, A. S.; Nikonorov, S. I.; Gusel'nikov, V. I. (M. V. Lomonosov Moscow State Univ., Moscow, USSR) **Analiz deistviya toksicheskikh veshchestv na tsentral'nuyu sistemu ryb v svete problemu biotestirovaniya kachestva vodnoi sredu. [Analysis of the effect of toxic substances on the CNS of fish in reference to the problem of the biotesting of water quality.]** *Biol. Nauk. (Moscow)* (12): 5-18; 1980 (82 references) (Russian).

Previously reported data on the effects of various water pollutants on the central nervous system (CNS) of fish are reviewed. Acute pesticide poisoning results in unstable swimming, respiratory distress and convulsions. Poisoning also increases sensitivity to external stimuli. Significant correlations have been found between motor disturbances and nerve tissue pathology. Biochemical changes in nerve tissue after pesticide exposure can be used as a criterion of the functional changes of CNS. Use of the functional parameters of CNS activity are recommended for estimating maximum permissible concentrations of pesticides and other toxic substances in water.

81-1651. Paulov, S. (Dep. Gen. Zool. & Anim. Physiol., Coll. Nat. Sci., Comenius Univ., Bratislava, Czechoslovakia) **Rizikovost fungicidu afuganu (pyrazofos) pre vyvin obojzivelnikov (*Rana temporaria* L.). [Hazards of the fungicide Afugan (pyrazophos) for the development of amphibians (*Rana temporaria* L.).]** *Biologia (Bratislava)* 36(2): 135-140; 1981 (9 references) (Czech).

The effect of the fungicide Afugan (AI pyrazophos) on the development, and GOT and GPT enzymatic activities, of 22 day old amphibian tadpoles (*Rana temporaria*) was examined. Afugan concentrations > 1 mg/l had a lethal effect. The 0.1 mg/l sublethal concentration stimulated tadpole growth. Front leg development, atmospheric respiration, and tail resorption were accelerated by 2 days. However, animals died before metamorphosis; in these specimens GOT activity increased while GPT activity decreased. It is concluded that Afugan represents a potential risk for natural ecosystems, and should be used only within the framework of integrated pest control where it cannot contaminate useful surface and groundwater resources.

81-1652. Wingfield, G. I.; Johnson, J. M. (Weed Res. Organ., Agric. Res. Counc., Begbroke Hill, Yarnton, Oxford OX5 1PF, England) **Deoxygenation of water following use of the herbicide terbutryn simulated in a batch culture system.** *Bull. Environ. Contam. Toxicol.* 26(1): 65-72; 1981 (10 references).

The effects of the herbicide terbutryne on microbial populations and oxygen levels in water from a small reservoir were investigated. The herbicide was added to lake water samples at 0.1 ppm. Terbutryne residues were measured by gas chromatography or by high pressure liquid chromatography. *Stichococcus* sp. was cultured and added to the lake samples at a density of 3.2×10^8 cells/ml. Samples were analyzed at routine intervals throughout this study. Dissolved oxygen decreased steadily and reached 0 ppm by 160 hr, then rose sharply and reached control levels by 200 hr. Algae (*Stichococcus* sp.) decreased steadily until 160 hr, then began to increase. Bacteria increased and peaked at 160 hr, then began to decrease. The deoxygenation appeared to be due to herbicide induced death of the algae. Further work, with sediments and aquatic macrophytes in this system, is recommended.

81-1653. Sullivan, D. S.; Sullivan, T. P.; Bisalputra, T. (Northwest Ecol. Anim. Res. Ltd., Vancouver, British Columbia V6T 1K9, Canada) **Effects of Roundup herbicide on diatom populations in the aquatic environment of a coastal forest.** *Bull. Environ. Contam. Toxicol.* 26(1): 91-96; 1981 (17 references).

The effects of the herbicide Roundup (356 μg/l glyphosate) on algae (diatoms) was studied in 2 streams and 1 pond under 2 different experimental conditions. In the first experiment an experimental area consisting of a small rocky stream leading to a small pond was exposed to Roundup by aerial application at 2.2 kg AI/ha. Sediment samples and glass slides placed in the water were removed immediately prior to spraying and 1, 5, 30 and 47 days after spraying. Diatoms were identified in sediment samples. Photographs were taken of slide samples for identification and counting of genera. Pond sediment samples showed an increase in the *Tabellaria* in the treated area compared to the controls, and a decline in total diatoms over time. *Navicula* and *Cymbella* showed a significantly higher density in the experimental area. Pond slides showed significant changes with time in several of the dominant species. Low density in stream samples precluded their analysis. In a second experiment, one area of the study stream was misted manually with Roundup at field dose (2.2 kg/ha) and another section was misted with 10 times field dose. Each area contained a slide tray containing upright slides; these were analyzed as in the first experiment. Differences in densities of the various genera were determined to be due to environmental differences. It was concluded from these studies that variation in abundance of diatoms was mainly determined by habitat and seasonal factors.

81-1654. Tagatz, M. E.; Ivey, J. M.; Gregory, N. R.; Oglesby, J. L. (Environ. Res. Lab., US EPA, Gulf Breeze,

FL 32561) **Effects of pentachlorophenol on field- and laboratory-developed estuarine benthic communities.** *Bull. Environ. Contam. Toxicol.* 26(1): 137-143; 1981 (5 references).

Studies were conducted in which established estuarine benthic communities were exposed to pentachlorophenol (PCP). Benthic communities were allowed to develop for 8 wk in both field and laboratory aquaria, then exposed to PCP for 7 days. Average PCP concentrations were 0.9, 13 and 141 μg/l in field-developed communities, and 1.1, 13 and 140 μg/l in laboratory-developed communities. After 1 wk of exposure, animals were collected by sieving and identified. Field communities yielded 346 animals representing 32 species of 6 phyla. Laboratory communities contained 800 animals representing 24 species of 10 phyla. Community structures were significantly altered by the 140 and 141 μg/l levels; average numbers of species/aquarium were less in these aquaria than in controls. The number of individuals was significantly less only in the laboratory-developed communities. Effects on the various phyla are discussed. The effects of PCP on annelids were species dependent. Molluscs exposed to the highest level were significantly effected. Arthropods (primarily amphipod crustaceans) and chordates (the tunicate *Mogula manhattensis*) treated with PCP did not significantly differ from those in control communities.

81-1655. Chin, B. H.; McGloin, J. B.; Spangler, N. L.; Heilman, R. D. (Dep. Saf. Assess., Diamond Shamrock Corp., Painesville, OH 44077) **Chlorothalonil equivalents in the blood and urine of rats following oral, endotracheal, and dermal administration of ^{14}C-chlorothalonil.** *Bull. Environ. Contam. Toxicol.* 26(1): 258-261; 1981 (1 reference).

The potential for absorption of the fungicide chlorothalonil in mammalian systems was investigated. Rat blood and urine chlorothalonil concentrations following oral, endotracheal and dermal administration of ^{14}C-chlorothalonil were determined. All rats received 5 μCi doses. Blood was collected at 2.5, 5.0, 24 and 48 hr post-exposure. Urine was collected at 24 and 48 hr. Endothracheal exposure resulted in the highest levels in blood. ^{14}C Equivalents in the blood were 5.2% within 2.5 hr, and 3.7% after 48 hr. Oral and dermal dosing resulted in 0.35 and 0.3% equivalents, respectively, after 2.5 hr. After 48 hr oral and dermal doses resulted in 0.23 and 0.27% equivalents, respectively, in the blood. Urine analysis after 48 hr resulted in 0.7, 0.7 and 0.8% equivalents due to endotracheal, oral and dermal doses, respectively. This study indicates the relative importance of differing routes of exposure to absorption of the fungicide chlorothalonil.

81-1656. Wszolek, P. C.; LaFaunce, N. A.; Wachs, T.; Lisk, D. J. (Toxic Chem. Lab., New York State Coll. Agric. & Life Sci., Cornell Univ., Ithaca, NY 14853) **Studies of possible bovine urinary excretion and rumen decomposition of fenvalerate insecticide and a metabolite.** *Bull. Environ. Contam. Toxicol.* 26(1): 262-266; 1981 (6 references).

Fenvalerate excretion in dairy cows and fenvalerate decomposition in bovine rumen fluid were investigated. Fenvalerate-fortified grain (227 mg/22.7 kg grain) was fed to a Holstein cow for 4 days. Urine samples were taken before, during, and after treatment. Rumen samples were removed from a second cow undergoing similar treatment. Fenvalerate was not detected in the urine during this study. Analysis for metabolites could not confirm the presence of the acid metabolite 4-chloro-α-(1- methylethyl)-benzeneacetic acid. No significant degradation of fenvalerate was detected by the end of short term incubation of the insecticide in rumen fluid. It is concluded that degradation takes place further along the digestive system.

81-1657. Plowright, R. C.; Rodd, F. H. (Dep. Zool., Univ. Toronto, Toronto, Ontario M5S 1A1, Canada) **The effect of aerial insecticide spraying on hymenopterous pollinators in New Brunswick.** *Can. Entomol.* 112(3): 259; 1980 (8 references).

The effects on several hymenopteran taxa of aerially sprayed fenitrothion (210 g/ha) and aminocarb (70 g/ha) in New Brunswick were reported. Fenitrothion caused high mortality among solitary bees and vespid wasps in exposure cage experiments. Aminocarb in caged exposure studies did not produce increased mortality for bumble bees. However an effect on solitary bees was observed. Results comparable to the exposure cage studies were obtained when whole colonies of bees were set in the fields several days before spraying. Bumble bee populations in sprayed areas were significantly reduced after fenitrothion spraying. Population recovery in concluded to be influenced by meteorological conditions over the remainder of the season. Aminocarb was not found to influence bee densities.

81-1658. Courtemanch, D. L.; Gibbs, K. E. (Maine Dep. Environ. Prot., Augusta, ME 04333) **Short-term and long-term effects of forest spraying of carbaryl (Sevin-4-oil) on stream invertebrates.** *Can. Entomol.* 112(3): 271-277; 1980 (9 references).

The short and long-term effects of carbaryl application to forests for spruce budworm control on stream invertebrate populations were studied. Nine streams in the Fish River drainage system of northern Maine were monitored. Three streams were in untreated areas. Three 1-yr treated streams were in areas treated at a rate of 840 g AI/ha in June of 1976. Three 2-yr treated streams were in areas treated at a rate of 840 g AI/ha in the year of the study and 1120 g AI/ha in the previous year. Initial post-spray response included an increase in drift of up to 170 times in treated areas. Significant declines among

Plecoptera, Ephemeroptera and Trichoptera populations were recorded. Plecoptera did not repopulate by 60 days post-treatment. Pre-spray Plecoptera populations were significantly lower in the 2nd year, in streams treated for 2 consecutive years. Diptera, with the exception of *Microtendipes*, and Oligochaeta were not affected.

81-1659. Hsia, M. T. S.; Kreamer, B. L. (Cent. Environ. Toxicol., Russell Lab., Univ. Wisconsin, Madison, WI 53706) **Metabolism studies of 3,3',4,4'-tetrachloroazobenzene. I. *In vitro* metabolic pathways with rat liver microsomes.** *Chem. Biol. Interact.* 34(1): 19-29; 1981 (21 references).

In vitro metabolism studies using induced rat liver microsomes were carried out on the toxin 3,3',4,4'-tetrachloroazobenzene (TCAB). TCAB is a microbial degradation product of several pesticides, including propanil. The studies were performed in a NADPH-generating system. Metabolites were determined by the combined use of high pressure liquid chromatography and gas chromatography-mass spectrometry. The rate of (^{14}C)TCAB metabolism using induced microsomes was determined to be 381 ± 59 pmol/min/mg microsomal protein. Three distinct metabolites were identified, including TCAB-phenol. It was determined that the cytochrome P-459 dependent monooxygenases are involved, and it was suggested that the generation of a reactive arene oxide intermediate mediated by oxidative enzymes may be important in the observed toxic effects. The results are discussed in terms of the molecular events by which TCAB produces pathological lesions.

81-1660. Kramer, M. S.; Hutchinson, T. A.; Rudnick, S. A.; Leventhal, J. M.; Feinstein, A. R. (Montreal Child. Hosp., Montreal, Quebec H3H 1P3, Canada) **Operational criteria for adverse drug reactions in evaluating suspected toxicity of a popular scabicide.** *Clin. Pharmacol. Ther.* 27(2): 149-155; 1980 (28 references).

The evidence suggesting that 1% γ-benzene hexachloride (lindane; GBH) is not a safe medication was investigated. The drug was suspected of causing central nervous system toxicity, especially in children. Of the 53 cases that had been reported of drug toxicity, lindane had been used in 37 cases, which is not a pharmaceutical preparation and which contains more than 1% GBH. Of the 26 cases in which 1% GBH had been used, only 6 cases were listed as probable adverse drug reactions, while none was considered definite. The conclusion from the investigation was that 1% GBH is a safe medication when used according to instructions. The confusion has primarily arisen from physicians not distinguishing between the insecticide and the drug formulations. However, it is noted that even when given in excessive doses or ingested by mouth, the drug may cause seizures, especially in young children.

81-1661. Rath, S.; Misra, B. N. (Lab. Environ. Toxicol., Dep. Bot., Berhampur Univ., Berhampur 760007, Orissa, India) **Pigment dispersion in *Tilapia mossambica* Peters exposed to dichlorvos (DDVP).** *Curr. Sci.* 49(23): 907-909; 1980 (8 references).

In this letter to the editor, 2 studies of pigment dispersion in *Tilapia mossambica* Peters exposed to dichlorvos are presented. Thirty healthy fish were exposed to 1.0 mg/l dichlorvos for 10 days. Another group of 10 fish was exposed to 1.0 mg/l for 5 days. Dichlorvos was found to stimulate melanin dispersion indirectly by inhibiting acetylcholinesterase. The dispersion of melanin pigment in the melanophores of scales and split fin preparations, isolated into sodium free saline containing dichlorvos, suggested a possible activation of pigment movement by the insecticide. A variation in physiology of pigment movement in chromatophores was marked in *Tilapia* in relation to increasing concentration of the pesticide and exposure period. After transfer of the fish to clean water they gradually regained their original color. Chromatic aggregation was exhibited within 96 hr. In unaltered, dichlorvos exposed medium the insecticide is lost slowly by absorption and biodegradation by the fish.

81-1662. Broadbent, A. B. (Univ. Guelph, Guelph, Ontario, Canada) **Assessment of a litterbag technique for studying the decomposition of leaf litter and the effects of carbofuran on non-target soil invertebrates.** *Diss. Abstr. Int. B* 41(8): 2891-2892; 1981.

To test the sensitivity of the litterbag technique, the decomposition of corn leaves in a cornfield was studied following treatment with carbofuran. Both row and broadcast treatments at the recommended rate and 10 times this rate were used. The corn leaf decomposed at rates that were positively correlated with mesh size, indicating that, despite insecticidal stress, most components of the soil fauna still participated in the process of decomposition. Although carbofuran treatment depressed the rate of decomposition for 1-3 wk, there were no long-term effects. Analysis of some taxa of Acari and Collembola by soil corn extraction in Tullgren-Berlese funnels revealed a depression in population following treatment in May, but recovery to or exceeding levels of untreated plots by October. Some short-term effects of carbofuran on populations of microarthropods were identified. Prostigmatid mites, particularly the saprophagous *Bakerdania* sp. (Pygmephoridae), increased following treatment at the recommended rate. Where carbofuran was applied at 10 times this dosage there was an increase in the saprophagous astigmatid mites. The mainly predacious mesostigmatid mites always decreased following treatment, but populations recovered by autumn. A predator/prey relationship was suggested from the decrease in predacious mites and the coincident increase in saprophagous mites following treatment. Earthworm biomass in the cornfield was not significantly different among control, carbofuran row or broadcast treatments at recommended rates 6 mo after treatment. Treatment at the

high rate caused swellings and abnormal pigmentation in earthworms. The high rate also had an adverse effect on millipedes, which were apparently important decomposers in the cornfield. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms).

81-1663. Al-Jabery, I. A. R. (Utah State Univ., Logan, UT) **Pesticide exposure studies: direct and indirect detection of absorption of 2,4-D and pronamide herbicides in the guinea pig and occupationally exposed workers.** *Diss. Abstr. Int. B* 41(8): 2947; 1981.

A simple high pressure liquid chromatography procedure was used to determine 2,4-D and pronamide exposure in sprayers and their dermal absorption and excretion in guinea pigs. Results of dermal application of these herbicides to guinea pigs demonstrated a strong correlation between the applied dermal dose and the urinary residue excretion over the dosage range tested. As the dosage was increased, the urinary excretion of residues was also increased. However, the excretion of 2,4-D amine mixture following dermal treatment of guinea pigs was prolonged compared to that of pronamide. Residue levels of these compounds were also determined to estimate skin contamination after sampling by filter pads attached to the clothing and arms of agricultural sprayers. Residues in the workers' urine before and after exposure were also determined. Average exposure values of 44.93 mg/hr/person for 2,4-D and 0.83 mg/hr/person for pronamide were extrapolated from residue values obtained from analyzing the pads. Little correlation was found between the measured residues from exposed subjects and residues quantified in their urine samples. (Author abstract by permission. Copies of the thesis are available from University Microfilms, order No. 8104266)

81-1664. Fan, A. M. M. (Utah State Univ., Logan, UT) **Effects of pesticides on immune competency: influence of methyl parathion and carbofuran on immunologic responses to *Salmonella typhimurium* infection.** *Diss. Abstr. Int. B* 41(8): 2962; 1981.

Immunologic competence is correlated with resistance to infectious disease which may be affected by exposure to certain compounds. Methyl parathion (MP) and carbofuran (CF) have been reported to affect the development of active immunity in the rabbit and the present research was conducted to quantify the dosage relationships of these 2 pesticides to both host resistance and acquired resistance in the mouse. Preliminary study was made on the virulence of *Salmonella typhimurium* in mice. Mortality rates among infected animals fed Purina Laboratory Chow diet providing 0.08, 0.7, 3.0 mg MP/kg/day or 0.1, 0.6, 1.0 mg CF/kg/day along with untreated controls were determined and the protection afforded the animals by vaccination under the influence of chemical treatment was examined. The nature of dose response was further investigated with the study of various parameters of host defense against microbial infection. Dosage-related increases in mortality was seen in unvaccinated mice under both chemical treatments, and protection by immunization was decreased. Pesticide treatment extending beyond 2 wk was required to obtain significant increases in mortality. Increased mortality was associated with increased numbers of viable bacteria in blood, decreased total gamma-globulins and specific immunoglobulins in serum, and reduced splenic blast transformation in response to mitogens. Serum opsonic activity of CF-treated animals was slightly reduced. These results support those of other investigations indicating effects of environmental toxicants upon the resistance and immune competency of experimental animals. (Author abstract by permission. Copies of the thesis are available from University Microfilms, order No. 8104106)

81-1665. Massey, E. W.; Scherokman, B. (Med. Cent., Duke Univ., Durham, NC) **The many causes of acute weakness.** *Emerg. Med.* 13(4): 31-34; 1981.

Correct procedures to follow when a patient presents with acute generalized weakness is described. An onset of generalized weakness over a period of a few weeks may indicate an accumulated dose of an environmental toxin or polymyositis. Quickly on-coming weakness may indicate a sudden massive dose of an environmental toxin. Possible exposure to pesticides, including occupational exposures, should be determined. Systemic reactions can indicate specific causes. For example, myoneural junction defects suggest pesticide poisoning. Mental changes can result from organophosphate pesticide exposure. In addition to weakness, symptoms of organophosphate poisoning can include frontal headache, visual difficulties, miosis, nausea, vomiting, tightness in the chest, diarrhea, and increased sweating, salivation and tearing. Anxiety and restlessness may be followed by drowsiness, confusion, slurred speech, and absent reflexes. Coma, convulsions, and death may follow from either respiratory or circulatory failure. Blood cholinesterase studies may also give useful results.

81-1666. Hoy, J. B. (Div. Biol. Control, Dep. Entomol. Sci., Univ. California, Berkeley, CA 94720) **Ecological impact of lindane on a pine plantation soil microarthropod community.** *Environ. Entomol.* 9(2): 164-174; 1980 (17 references).

Following simulated operational spraying of trees with 1% lindane emulsion, applied to run-off, soil residues were ca. 30 ppm in the top 76 mm of the soil, with very little residue below the top 12 mm. Directly sprayed plots were treated so that residues were at a base rate (29 ppm in the top 76 mm), and 10 times the base rate. Soil arthropods were extracted with Berlese funnels. Surface samples were

taken before the plots were treated and 3, 9, 21, 45, 93 and 141 days post-treatment. Subsurface samples were taken 30 and 155 days post-treatment. Fourteen of 17 cryptostigmatid species showed a significant effect during at least one sampling period, most at the high dosage rate. Nine of 12 prostigmatid families showed a change in numbers. The mesostigmatid mites were generally not reduced in numbers. The Collembola families were all affected, 1 strikingly, 3 others less so. Seasonal differences in lindane effect (some delayed) were found in the Cryptostigmata and Prostigmata. The Cryptostigmata demonstrated a reduction in heterogeneity and a change in community structure at 10 times the base rate. (Author abstract by permission)

81-1667. Gayathri, M. V.; Krishnamurthy, N. B. (Dep. Post-Grad. Stud. & Res. Zool., Univ. Mysore, Mysore 57006, India) **Studies on the toxicity of the mercurial fungicide Agallol 3 in *Drosophilia melanogaster*.** *Environ. Res.* 24(1): 89-95; 1981 (25 references).

Effects of a mercurial fungicide Agallol 3 (MEMC), widely used for treating sugarcane sets and seed potatoes, was studied on *Drosophilia melanogaster* by using parameters such as viability, rate of development, fecundity, hatchability, fertility, and reproductive performance. The chemical was administered by larval feeding. Concentrations of 20, 30, 40, 50 and 60 mg in every 100 ml of food medium were used. In all the concentrations, a significant effect on viability and rate of development was observed. Fecundity was significantly reduced in all the concentrations tested, while hatchability and fertility were not significantly affected. Reproductive performance (mean No. of offspring/pair for a specific period) was highly reduced. Such an effect of an alkoxyalkylmercury fungicide is discussed in the light of the effects caused by other organomercurials. (Author abstract by permission of Academic Press)

81-1668. Verma, S. R.; Saroj Rani; Dalela, R. C. (Pollut. Relevent Res. Lab., Post Grad. Dep. Zool., D.A.V. Coll., Muzaffarnagar 251001, India) **Responses of serum transaminases in *Notopterus notopterus* chronically exposed to phenolic compounds and their combinations.** *Environ. Res.* 24(1): 218-223; 1981 (25 references).

Specimens of *Notopterus notopterus* were exposed to sublethal concentrations (10, 15, and 20 times diluted 96-hr LC50) of phenol (P), dinitrophenol (DNP), pentachlorophenol (PCP), and their 3 combinations – additive [(DNP + P)/PCP], antagonistic [(PCP + DNP/P], and synergistic [(P + DNP)/PCP] – for 30 days and their effects on serum transaminases (SGOT and SGPT) were studied. Significant ($P < 0.05$, $P < 0.01$, $P < 0.001$) enzymatic alterations were observed after treatment. The maximum stimulation (127.76%) was observed in SGOT at the highest concentration of the (P + DPN)/PCP combination and the minimum stimulation (6.67%) was observed in SGPT at the 20 times dilution concentration of the (PCP + DNP)/P combination after 30 days. However, inhibition in enzyme activity at the lowest concentration of P, DNP, and the (PCP + DNP)/P combination was also occasionally observed. (Author abstract by permission of Academic Press)

81-1669. Plumley, F. G.; Davis, D. E. (Dep. Bot. Microbiol., Auburn Univ., Agric. Exp. Stn., Auburn, AL 36830) **The effects of a photosynthesis inhibitor atrazine, on salt march edaphic algae, in culture, microecosystems, and in the field.** *Estuaries* 3(4): 271-277; 1980 (33 references).

The effects of atrazine on salt marsh edaphic algae were studied. *Thalassiosira fluviatilis* and *Nitzschia sigma* were each grown in culture, and exposed to 0, 10^{-7}, 10^{-6} and 10^{-5} *M* atrazine (0, 0.022, 0.22 and 2.2 ppm) for 7 days. The 2.2 ppm test reduced the rate of photosynthesis, chlorophyll content and cell numbers of both species. The effects of atrazine on edaphic algae in a microecosystem were determined by placing a sample of creek-bottom mud in a system of tubes which were sequentially flushed with salt and fresh water, simulating high and low tides. Atrazine at 2.2 ppm was added at the high tide cycle; photosynthesis, chlorophyll content and cell numbers decreased. Field studies were conducted by placing creek bank surface soil in perforated tubs which were partially buried in the creek bank, thus exposing the soil to the tides. After 7 days the tubs were flooded with water containing either 0 or 10^{-5} *M* atrazine. The results were similar to those of the microecosystem study, although less severe. Although species diversity did not decrease, the number of *Cymatosira belgica* increased. It is suggested that 10 ppb is a safe level for atrazine in the salt marsh.

81-1670. Uzodinma, J. E.; Trottman, C. H.; Bansal, S. K.; Desaiah, D. (Dep. Biol. & Chem., Jackson State Univ., Jackson, MS 39216) **Sensitivity of developing rat brain ATPases to chlordecone.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 251; 1981.

Adult rat brain ATPases were previously shown to be inhibited by chlordecone (C). However, the effect of C on maturing rat brain ATPases was not investigated. Nerve ending fractions of brains of male Sprague-Dawley rat pups of 5, 10 and 21 days old were prepared and used as enzyme source. Na^+K^+, oligomycin-sensitive (O.S) and insensitive (O.I) Mg^{2+} ATPases were determined in the absence and presence of 0.5 and 1.0 μM C. There was an age dependent increase in the enzyme activities. Na^+K^+ ATPase was increased from a specific activity (μ mol Pi/mg pr/hr) of 24.5 in 5 day old to 55.5 in 21 day old rat brains. O.S Mg^{2+} ATPase was increased from 4.7 to 6.7 and O.I Mg^{2+} ATPase was increased from 9.6 to 14.8. Na^+K^+ and O.S Mg^{2+} ATPases were inhibited by C in all age groups and O.I

Mg^{2+} ATPase was not significantly affected by C. These findings are consistent with our previously reported results with adult rat brain ATPases. Na^+K^+ ATPase in 5 and 10 day old brain was more sensitive to C than 21 day old rats. O.S Mg^{2+} ATPase, on the other hand, was inhibited by C to the same extent in all age groups. These results suggest that ATPase activities increase with age up to 21 days and C may be more effective on Na^+K^+ ATPase in younger rat brains as compared to older rats. The sensitivity of O.S Mg^{2+} ATPase to C is the same at all ages. [Abstract # 87.] (Author abstract by permission)

81-1671. Carlson, C. G.; Detterbarn, W. D. (Vanderbilt Univ., Nashville, TN 37232) **The effects of repeated injections of paraoxon on spontaneous transmitter release at the rat diaphragm.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 262; 1981.

Adult male rats were sacrificed at 0.5 hr after 1, 3, 7 or 14 daily injections of paraoxon (Px), and at 0.5 hr following a single injection on the 7th, 14th or 21st day of recovery following 14 daily injections. After a single injection, the miniature endplate potential (MEPP) frequency and the frequency of giant potentials were elevated in 30% and 80% of the fibers in the hemidiaphragm. The giant frequency increased between fibers with the overall MEPP frequency but the percentage of giants was larger for fibers with control MEPP frequencies. Following 3 daily injections, the MEPP frequency was reduced below control levels in all the fibers, and after 7 or 14 injections the MEPP frequency approached control levels. During recovery from the repeated administrations, a single injection of Px once again produced effects similar to those seen with a naive preparation. Although the preparations treated with 3 daily injections had much lower MEPP frequencies than those treated with one injection, both groups responded similarly to increases in the potassium concentration. Therefore, it is unlikely that potassium depolarization is responsible for the increased MEPP frequency produced by Px. Instead, the increased frequency of giant potentials suggests that either Px itself, or ACh, may interact with the presynaptic calcium channels responsible for regulating the rate of quantal release. [Abstract # 153.] (Author abstract by permission)

81-1672. McDonough, J.; Hackley, B.; Cross, R.; Samson, F.; Nelson, S. (Biomed. Lab., US Army, Aberdeen, MD) **Brain regional glucose use during soman-induced seizures.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 271; 1981.

Sprague-Dawley rats (200-250 g) were injected with soman, a potent AChE inhibitor. Salivation occurred 3-5 min later followed by muscle tremors. Most rats developed seizures. ^{14}C-2-Deoxyglucose was injected iv, 15 min after soman, and autoradiographs from 11 rats with seizures were studied (8 rats received 112 μg/kg; 3 rats, 84 μg/kg). Very high rates of glucose use occurred in cerebral cortex, caudate, thalamus, median geniculate N., outer layer of dentate gyrus of the hippocampus, substantia nigra and interpeduncular nucleus. Not increased were hypothalamus, globus pallidus, reticular formation, superior and inferior colliculi and mammillary body. Surprisingly, layer 3 and/or 4 of cerebral cortex, rostral to superior colliculus, showed marked reduction in glucose use. This may represent inhibition of neuronal activity or cell death. Pretreatment with cholinergic blockers prevented the seizures as well as the increases in rates of glucose use. Sub-seizure doses of soman tended to decrease rates of glucose use in gray matter. [Abstract # 204.] (Author abstract by permission)

81-1673. Kim, S. J.; Roberts, J. F.; Koo, J. O. (North Carolina State Univ., Raleigh, NC 27650) **Effects of paraquat on angiotensin in converting enzyme activity in mice brains.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 276; 1981.

Ninety-six adult ICR *Mus musculus*, weighing 31-35 g, 7-20 wk of age of both sexes, were treated ip with paraquat (PQ: 1,1′-dimethyl-4,4′-bipyridylium dichloride), 30 mg/kg body wt. Activities of brain angiotensin converting enzyme (ACE) were measured in the PQ-treated group and in 19 vehicle-treated controls after 24, 48, 72, and 96 hr. The ACE in the PQ-group showed a statistically insignificant increase over the controls (mean + SE; 4.8 ± 0.6 vs 3.4 ± 1.3 n*M*/min · mg protein) except after 96 hr (9.7 ± 0.8, $P < 0.05$). The brain wt (Brwt) in the PQ-group maintained a rather constant level (0.42 ± 0.01 vs 0.47 ± 0.01 g) and changes in the Brwt/body wt ratio (0.0154 vs 0.0143) were not significant. Brain protein concentrations in the PQ-group decreased (121.6 ± 4.3 mg/g tissue, $P < 0.01$ at 24 hr; 106.3 ± 4.4, $P < 0.01$ at 48 hr; 127.3 ± 7.6 at 72 hr; 114.2 ± 6.4 at 96 hr) vs controls (150.0 ± 9.2). Cerebral hemorrhage was noted in dura mater in the brains of younger mice (7-10-wk-old). SQ 2,0881 (1×10^{-6} *M*) inhibited the ACE activity completely. These data suggest that PQ may somehow be able to cross the blood-brain barrier despite its being a quaternary compound and perturbs an intricate balance of brain ACE homeostasis with concomitant decrease of protein concentration during the experimental period. [Abstract # 231.] (Author abstract by permission)

81-1674. Yarbrough, J. D.; Grimley, J. M. (Mississippi State Univ., Mississippi State, MS 39762) **The effect of chlorinated alicyclic insecticides on calcium flux in synaptosomes of mosquito fish *(Gambusia affinis).*** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 324; 1981.

Chlorinated alicyclic insecticides may exert a primary toxic effect on neurotransmitter release by disrupting the control of intracellular synaptic Ca^{++} levels. Synaptosomes provide an *in vitro* system whereby the role of Ca^{++}

in transmitter release may be studied. Calcium fluxes were investigated in synaptosomes prepared from brain tissue of mosquito fish *(Gambusia affinis)*. Compounds investigated included: dieldrin, aldrin, aldrin transdiol, endrin, ketoendrin, heptachlor, heptachlor epoxide, chlordane and lindane. Most compounds at 10^{-9}-10^{-7} *M* had no effect on synaptosome uptake of Ca^{++} (influx). However, with the exception of lindane at 10^{-5} *M*, all compounds tested showed 30-40% reductions in calcium uptake. Calcium release (efflux) appeared to follow a similar pattern. [Abstract # 519.] (Author abstract by permission)

81-1675. Block, E. R. (Univ. Florida, Gainesville, FL 32610) **Alpha naphthylthiourea (ANTU) protects against hyperoxic depression of pulmonary uptake of serotonin (S).** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 426; 1981.

Both high partial pressure of O_2 (HPPO) and ANTU injure pulmonary endothelial cells and depress the specific uptake of serotonin (S) by these cells. However, animals given ANTU have prolonged survival when subsequently exposed to HPPO. To evaluate whether ANTU protects against HPPO-induced endothelial injury, we studied uptake of S by the lungs of ANTU-treated rats subsequently exposed to HPPO. Rats were given 5 mg/kg ANTU in Tween 80 or an equal volume of Tween 80 (controls) ip. One wk later rats were exposed to air or 100% O_2 at 1 ATA × 24 hr after which uptake of 14C-S was measured in isolated lungs excised from these animals. An additional group of ANTU or Tween 80 treated rats were exposed to 100% O_2 for 7 days and survival was monitored. S uptake (mean + SE nmol/min/g lung) in ANTU-treated rats exposed to air (2.82 ± 0.33) was depressed compared to S uptake in control rats exposed to air (3.73 ± 0.14, $p < 0.05$) but was similar to S uptake in control rats exposed to 100% O_2 (2.88 ± 0.08) and S uptake in ANTU-treated rats exposed to 100% O_2 (2.73 ± 0.13). Survival studies revealed that 9 of 14 ANTU-treated rats were alive after 7 days exposure to 100% O_2 while only 1 of 14 control rats was alive ($p < 0.001$). These results indicate that ANTU injures pulmonary endothelial cells, as manifested by depressed S uptake, but also protects against subsequent endothelial injury and mortality due to HPPO. [Abstract # 1107.] (Author abstract by permission)

81-1676. Talcott, R.; Ketterman, A. (North. California Occup. Health Cent., Univ. California, San Francisco, CA 94110) **Malathion carboxylesterase as a possible marker for structurally-damaged liver endoplasmic reticulum.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 520; 1981.

Malathion carboxylesterase activity can be assayed by coupling the hydrolysis to the reduction of a tetrazolium dye. Assays in rodent liver show that most of the activity is microsomal, and may be solubilized either by exposure to low detergent concentrations or by peroxidation of microsomal lipids. *In vivo*, release of malathion carboxylesterases from the endoplasmic reticulum appears to occur following carbon tetrachloride treatment of male Swiss-Webster mice. Antioxidant feeding appears to have the opposite effect, indicating that the subcellular distribution of malathion carboxylesterase activity may reflect the integrity of the liver endoplasmic reticulum. In humans, serum malathion carboxylesterase titer was highly correlated with SGOT (n=47) and the highest titer was observed in a serum sample from a patient overdosed with acetominophen, a substance known to generate hepatotoxic metabolites. These results suggest that the activity of malathion carboxylesterase in human serum may increase when the liver is damaged, due to release of the enzyme from the endoplasmic reticulum. [Abstract # 1654.] (Author abstract by permission)

81-1677. Mishra, S. K.; Osborn, R. L.; Holland, D.; Desaiah, D. (Neurol. & Res. Serv., VA Med. Cent., Jackson, MS 39216) **Chlordecone activation of ATPases in rat brain microvessels.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 543; 1981.

Chlordecone (Kepone) has been shown to be a potent inhibitor of Na^+,K^+ and Mg^{2+}-ATPases in different tissue fractions. The present studies were initiated to determine the effect of chlordecone (C) on Na^+,K^+, oligomycin-sensitive (O-S) and insensitive (O-I) Mg^{2+}-ATPase activities in rat brain microvessels (RBMV). RBMV fraction was prepared by sucrose gradient centrifugation. The fraction obtained between 1.3 and 1.2 *M* sucrose contained the highest ATPase activities. Pre-incubation of RBMV with different concentrations (0.5-5 μM) of C resulted in an increase in the ATPase activities. The increase of Na^+,K^+-ATPase was biphasic. A gradual increase was observed with increase in the concentration of C, reaching a 2 fold increase at 1 μM followed by a decrease towards normal with further increase of C. However, O-S and O-I Mg^{2+}-ATPases were increased linearly with increased C in the reaction. A 5-fold increase of these enzyme activities were seen at the highest concentration of C. RBMV is the only fraction showing an increase in ATPase activities *in vitro* by C. The increase in RBMV ATPases by this neurotoxin in relation to its physiological action is not understood at present. [Abstract # 1783.] (Author abstract by permission)

81-1678. Klingensmith, J. S.; Mehendale, H. M. (Dep. Pharmacol. & Toxicol., Med. Cent., Univ. Mississippi, Jackson, MS 39216) **Chlordecone-induced lipolysis in the male rat.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 629; 1981.

The principal objective of this study was to quantitate the anatomical and biochemical parameters associated with the depletion of body fat stores by the pesticide, chlordecone. Groups of 5 male Sprague-Dawley

rats (150-175 g) were fed a control diet or a diet containing 100 ppm chlordecone for 5, 15 or 20 days. After the treatment period, animals were killed by exsanguination. Weight of the paired epididymal fat pads was taken to represent the anatomical marker for mobilization of body fat. Blood levels of acetoacetate, 3-hydroxybutyrate, triglycerides and nonesterified fatty acids were measured as biochemical markers for metabolic ketosis and for lipolysis of body fat depots. A consistent and significant difference was observed in the weight of epididymal fat pads between control and each of the treatment groups. The reduction in epididymal fat reached a maximum of 50% in the chlordecone-fed animals after 20 days. Circulating ketone bodies were not different in treated animals in any groups indicating that chlordecone treatment does not result in metabolic ketosis. Other biochemical parameters confirm the observation of chlordecone-induced lipolysis. These results show that while chlordecone treatment results in mobilization of body fat, this does not give rise to metabolic ketosis. [Abstract # 2285.] (Author abstract by permission)

81-1679. Potter, C.; Russell, D. H.; Sipes, I. G. (Health Sci. Cent., Univ. Arizona, Tucson, AZ 85724) **Effects of 2,3,7,8-tetrachlorodibenzo- *p*-dioxin on hepatic ornithine decarboxylase induction.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 629; 1981.

Ornithine decarboxylase (ODC, E.C.4.1.1.17), the rate-limiting enzyme in polyamine biosynthesis, increases in response to hypertrophic stimuli. Since 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) increases liver wt to body wt ratios and increases the activity of several liver enzymes, the effects of a single dose of TCDD (20 μg/kg, ip), administered 1 wk before liver stimulation, on the hepatic ODC activity in male Sprague-Dawley rats were studied. At 16 hr after partial hepatectomy, TCDD-treated rats exhibited a 3-4-fold increase in ODC activity, while vehicle controls (acetone-corn oil) exhibited an 8-10-fold increase. Since ODC induction occurs by either a cAMP-dependent event (aminophylline, 200 μmol/kg) or by direct nuclear action (dexamethasone, 0.5 mg/kg), the effects of this TCDD treatment on ODC induction were studied. The increase in ODC at 4 hr following ip administration of these agents to TCDD-treated rats was only 20-40% of that observed in vehicle controls. Pretreatment with TCDD 15 min prior to administration of these agents did not inhibit ODC induction. These results suggest that TCDD imposes a time-dependent alteration in the ability of hepatocytes to respond to metabolic, hypertrophic and/or regenerative stimuli of a diverse nature. [Abstract # 2286.] (Author abstract by permission)

81-1680. Hoskins, B.; Ho, I. K. (Dep. Pharmacol. & Toxicol., Med. Cent., Univ. Mississippi, Jackson, MS 39216) **Effects of chlordecone administrations on brain calcium contents in the mouse.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 629; 1981.

Age-matched male ICR mice were used to study effects of acute and chronic administration of chlordecone upon brain calcium. Twenty-four hr after a single oral dose of chlordecone (25 mg/kg) and 24 hr after the last of 8 daily doses (25 mg/kg); mice were sacrificed, whole brains were quickly removed, weighed and immediately frozen in liquid nitrogen. The whole brain from each mouse was homogenized in glass-distilled, deionized water and analyses of total calcium content and of calcium bound to TCA-precipitated protein were performed using atomic absorption spectrophotometry. Protein content of each brain was also determined. Twenty-four hr after the single dose of chlordecone, there was a significant increase in both total brain calcium content (~500%) and in protein-bound calcium (~750%), but there was no alteration in total body wt or in protein content of brain. Chronic (8 day) administration of chlordecone resulted in a significant decrease in total brain calcium content (~55% of controls) and further resulted in no detectable calcium binding to brain protein. Although brain protein content was unaffected by chronic chlordecone administration, body wts were approximately 20% less than those of age-matched controls. It appears that chlordecone affects brain calcium levels and that this effect may be related to chlordecone-induced neurotoxicity. [Abstract # 2287.] (Author abstract by permission)

81-1681. Bansal, S. K.; Desaiah, D. (Dep. Neurol., Med. Cent., Univ. Mississippi, Jackson, MS 39216) **Effects of ATP, Na^+ and K^+ on the inhibitory action of chlordecone on rat brain Na^+,K^+-ATPase.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 630; 1981.

The previous reports from our laboratory showed that chlordecone (C) was a potent inhibitor of Na^+,K^+-ATPase. The present studies were initiated to determine the effects of substrate (ATP) and cations (Na^+ and K^+) on the inhibitory action of C. Rat brain synaptosomal fraction prepared by ficoll-sucrose gradient centrifugation was used as the enzyme source. Na^+,K^+-ATPase was determined by coupled-enzymatic method. At optimum conditions (ATP: 5 m*M*; Na^+: 100 m*M*; Mg^{2+}: 5 m*M*) C inhibited the enzyme activity in a concentration dependent manner with an IC50 of 5 μ*M*. When the inhibition was measured with varying concentrations of ATP (0.3-5 m*M*), Na^+ (5-100 m*M*) and K^+ (0.4-20 m*M*) the IC50 values were significantly altered. With the increase in ATP the IC50 value was reduced from 9.2 to 5.5 μ*M* suggesting potentiation of C inhibition. A similar response was also observed with K^+, in that the IC50 was decreased from 6.4 to 5.0 μ*M* with an increase of K^+. However, an antagonist effect was observed with Na^+. The IC50 was increased from 4 to 5.5 μ*M* with the increase of Na^+ concentration. These suggest that C inhibition of Na^+,K^+-ATPase may be increased by ATP and K^+ and antagonized by Na^+. [Abstract # 2288.] (Author abstract by permission)

81-1682. Braunberg, R. C.; Gantt, O. O.; Keys, J. E.; Gaines, D. W.; Friedman, L. (US FDA, Washington, DC 20204) **Effect of pentachloroanisole (PCA) and pentachlorophenol (PCP) upon *in vitro* respiration of rat tissue.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 630; 1981 (1 reference).

PCP, a widely used pesticide, and one of its metabolites, PCA, have been reported to accumulate in the tissue of fish. Exposure of kidney explant cultures in Trowell's T-8 medium to 0.1 m*M* PCP for 18 hr resulted in an 80% decrease in respiration as measured by CO_2 production from ^{14}C glucose. PCA at this concentration produced an 85% increase in respiration, however. In the presence of PCP, but not PCA, at 0.8 m*M* protein leakage into the medium was significantly elevated (43%), indicating increased membrane permeability with PCP. In another system, kidney slice respiration is inhibited 30 and 70% after incubation for 1 hr with 0.1 m*M* and 0.8 m*M* PCP, respectively. On the other hand, PCA effected no significant change although slight stimulation also occurred in this system. Liver slice respiration was inhibited 53% by 0.8 m*M* PCP; PCA again, had no significant effect. Although PCP inhibited respiration in kidney tissue preparations, PCA had a stimulatory effect following 18-hr exposure of explants and had little effect after 1 hr exposure of tissue slices. PCP appears to be more toxic to kidney slice than to liver slice preparations. [Abstract # 2290.] (Author abstract by permission)

81-1683. Miller, T. L.; Lorusso, D. J.; Deinzer, M. L. (Dep. Agric. Chem., Oregon State Univ., Corvallis, OR 97331) **Induction of enzymes of the hepatic mixed function oxidase system by hydroxychlorodiphenyl ether contaminants of technical pentachlorophenol.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 630; 1981.

The effect of the membrane active hydroxychlorodiphenyl ether (HO-Cl_x-DPE) contaminants of technical pentachlorophenol (Tech PCP) on the activity of the hepatic mixed function oxidase (MFO) system was studied. Multiple ip injections of HO-Cl_x-DPEs at their LD1 dose in female CD-1 mice caused a dramatic increase in some MFO related components and in the ratios of liver to body wt and microsomal protein to liver wt. 2-HO-Cl_9-DPE (30 mg/kg/day for 4 days) induced aminopyrine *N*-demethylation, *p*-nitroanisole *O*-demethylation, and cytochrome *P*-450 and b_5 levels, while 3-HO-Cl_9-DPE (57 mg/kg/day for 4 days) only increased aminopyrine *N*-demethylation. 2-HO-Cl_3-DPE (107 mg/kg/day for 3 days) induced cytochrome *P*-450 and aminopyrine *N*-demethylation. Benzo[a]pyrene and aniline hydroxylase, UDP-glucuronyltransferase, and NADPH cytochrome *c* reductase were not induced by any of the HO-Cl_x-DPEs. The results show that the HO-Cl_x-DPEs are potent inducers of MFO related enzymes and suggest that some of the inducing activity of Tech PCP may be due to the HO-Cl_x-DPE contaminants. [Abstract # 2291.] (Author abstract by permission)

81-1684. Lorusso, D. J.; Miller, T. L.; Deinzer, M. L. (Dep. Agric. Chem., Oregon State Univ., Corvallis, OR 97331) **Further studies on the induction of hepatic mixed function oxidase enzymes by nonachloroprediоxin, a contaminant of technical pentachlorophenol.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 630; 1981.

2-HO-Cl_9-DPE, a hydroxychlorodiphenyl ether (HO-Cl_x-DPE) contaminant of technical pentachlorophenol (Tech PCP), has been found to be a potent inducer of aminopyrine *N*-demethylation, *p*-nitroanisole *O*-demethylation, and cytochrome *P*-450. A single ip dose of 2-HO-Cl_9-DPE (30 mg/kg) in CD-1 female mice caused a 1.5-fold increase in cytochrome *P*-450, a 1.9-fold increase in aminopyrine *N*-demethylation and a 2.3-fold increase in *p*-nitroanisole *O*-demethylation after 2 days. *p*-Nitroanisole *O*-demethylation remained induced for about 1 wk, while aminopyrine *N*-demethylation returned to control levels after 4 days. Multiple ip doses (30 mg/kg/-day) caused the maximum induction of cytochrome *P*-450 and aminopyrine *N*-demethylation after 3 days, while *p*-nitroanisole *O*-demethylation was maximally induced after 2 days. Dose-response curves for each of the enzymes induced were determined. To characterize the enzymes induced, *in vitro* inhibition studies using 2-HO-Cl_9-DPE and other HO-Cl_x-DPEs, and SKF-525A were conducted. 2-HO-Cl_9-DPE is a potent inducer of cytochrome *P*-450 and several enzymes associated with this protein. [Abstract # 2292.] (Author abstract by permission)

81-1685. Costa, L. G.; Hand, H.; Murphy, S. D. (Div. Toxicol., Med. Sch., Univ. Texas, Houston, TX 77025) **Tolerance to the carbamate insecticide propoxur.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 630; 1981.

Tolerance to organophosphorus (OP) insecticides toxicity is manifest by resistance to acute effects of cholinergic agonists and is associated with a decrease of muscarinic cholinergic receptors. To investigate if this mechanism could explain tolerance to carbamate insecticides, male mice were rendered tolerant to propoxur (2-isopropoxy phenyl methylcarbamate) by giving increasing concentrations of propoxur (50-2000 ppm) in the drinking water for 6 wk. Evidence of tolerance was an increase in the LD50 of propoxur from 25.4 ± 2.5 to 44.9 ± 3.9 mg/kg ($P < .05$) and development of resistance to the hypothermic effect of an acute dose of propoxur in the treated animals (maximum $\Delta T = 3.23 \pm 0.25$ *vs.* $1.95 \pm 26°C$; $P < .01$). Tolerant animals were not more resistant than controls to the actions of the cholinergic agonists carbachol and oxotremorine and exhibited no changes in binding of the muscarinic receptor ligand ^{3}H-QNB in central and peripheral tissues. The possibility of an alteration of propoxur metabolism was tested by measuring carboxyesterase (CarE) activity and hexobarbital sleeping time (HST). While CarE was not enhanced, HST was significantly decreased in the propoxur treated animals indicating an induction of the hepatic microsomal oxidases. Fast recovery of acetylcholinesterase activity after inhibition by propoxur

($t_{1/2}$ = 1 hr after an acute dose giving a detectable 50% inhibition in the diaphragm) could account for the lack of change of muscarinic receptors in propoxur tolerant animals. [Abstract # 2293.] (Author abstract by permission)

81-1686. Sadler, B. M.; Wosilait, W. D. (Dep. Pharmacol., Sch. Med., Univ. Missouri, Colombia, MO 65212) **Displacement of warfarin (W) from plasma proteins by sulfobromophthalein (BSP)** ***in vivo.*** ***Fed. Proc. Fed. Am. Soc. Exp. Biol.*** 40(3PT1): 639; 1981.

The inhibition of warfarin (W) elimination in the bile by BSP has been demonstrated repeatedly and modeled with a physiological flow model. BSP has also been shown to displace W from human serum albumin *in vitro.* This interaction was studied in anesthetized male Sprague-Dawley rats. ^{14}C-W (1 mg/kg iv) was given at time zero. BSP (50 mg/kg iv) was injected at 30, 50, 70, 90 and 110 min after W. Bile samples from the cannulated bile duct and blood samples from the snipped tail were collected every 5 min for 165 min. Equivalents of W were determined by scintillation counting and BSP measured spectrophotometrically. Immediately after each injection of BSP, radioactivity in the plasma decreased by 40% followed by a gradual increase as BSP was cleared from the plasma. As previously reported, radioactivity in the bile decreased by 75% after the injection of BSP and remained at that level over the collection period. It appears that in addition to inhibiting the excretion of W in the bile BSP also displaces W from plasma proteins *in vivo.* When BSP is injected, W (~ 30% of the injected dose) rapidly distributes to extravascular compartments. As BSP is cleared from the plasma, binding sites become available again and the W equilibrium between plasma and tissue returns to normal. The availability of plasma binding sites seems to play a major role in the distribution of W *in vivo.* [Abstract # 2343.] (Author abstract by permission)

81-1687. Sundheimer, D. W.; White, R.; Sipes, I. G.; Brendel, K. (Arizona Health Sci. Cent., Univ. Arizona, Tucson, AZ 85724) **Nucleic acid alkylation and production of DNA strand breaks by ethylene dibromide in isolated rat hepatocytes.** ***Fed. Proc. Fed. Am. Soc. Exp. Biol.*** 40(3PT1): 668; 1981.

The role of glutathion (GSH) in the bioactivation of ethylene dibromide (EDB) was investigated in isolated rat hepatocytes. Bioactivation was determined by measuring the covalent binding of ^{14}C-EDB to nucleic acids and detection of DNA strand breaks. For alkylation experiments, hepatocytes were incubated with 0.08 m*M* ^{14}C-EDB for 2 hr. Afterwards, nuclear and non-nuclear fractions were prepared by homogenization and subsequent isolation of the hepatic nucleic. The nucleic acids in each fraction were purified and then separated by hydroxlapatite chromatography. Of the ^{14}C-EDB bound to nucleic acids, 95% was present in nonnuclear DNA (0.65 nmol EDB/mg DNA). Three precent of the ^{14}-EDB bound to nucleic acids was present in nuclear DNA (0.65 nmol EDB/mg DNA). Incubation of ^{14}C-EDB with hepatocytes pretreated with diethylmaleate (0.75 m*M*), which reduced GSH levels by 50%, decreased alkylation of both DNA and RNA by 45%. Alkylation of the nuclear DNA was confirmed by the detection of DNA strand breaks and alkalilabile sites using the alkaline elution technique. EDB (0.01-0.1 m*M*) caused extensive DNA strand breaks at concentrations which did not alter the starting GSH level. EDB does not require GSH depletion before damaging cellular macromolecules and may in fact require GSH for its bioactivation. [Abstract # 2504.] (Author abstract by permission)

81-1688. Rankin, G. O. (Dep. Pharmacol., Sch. Med., Marshall Univ., Huntington, WV 25701) **Nephrotoxicity following acute administration of *N*-(3,5-dichlorophenyl) succinimide.** ***Fed. Proc. Fed. Am. Soc. Exp. Biol.*** 40(3PT1): 675; 1981.

The acute renal effects of the fungicide N-(3,5-dichlorophenyl) succinimide (NDPS; dimethachlon) were studied in male Sprague-Dawley rats (350-400 g). Rats received NDPS (50, 100 or 200 mg/kg, ip) or vehicle (sesame oil, 2.5 mg/kg, ip) and renal function was evaluated 24 or 48 hr post-injection. Change in urine volume (ml) was significantly increased at 24 hr by all doses (15.98 ± 3.71, 24.22 ± 2.67 and 30.89 ± 2.80 respectively; $p < 0.01$) and at 48 hr in the 100 and 200 mg/kg group (8.45 ± 3.37 and 17.83 ± 8.50 respectively; $p < 0.05$) when compared to controls [-2.78 ± 0.60 (24 hr), -2.90 ± 1.59 (48 hr]. Water intake was not different between groups. Renal uptake of organic ions was measured *in vitro* using the renal slice technique. NDPS, 50 mg/kg, did not affect renal uptake of *p*-aminohippuric acid (PAH), lactate-stimulated PAH (PAH-LAC) uptake or tetraethyl ammonium (TEA) uptake. At 100 mg/kg, PAH, PAH-LAC and TEA uptake were decreased at 24 hr (36, 51 and 25%↓ respectively; $p<$ 0.05) but only TEA was decreased at 48 hr (36%↓, $p<$ 0.05). At 200 mg/kg, PAH, PAH-LAC and TEA uptake were decreased at both 24 and 48 hr (41, 47 and 34%↓; 59, 75 and 42%↓, respectively; $p<$ 0.05). These data suggest that NDPS is nephrotoxic following acute administration. [Abstract # 2547.] (Author abstract by permission)

81-1689. Ellison, A. C.; Salman, K. N. (Dep. Clin. Pharm., Coll. Pharm., Univ. Riyadh, Riyadh, Saudi Arabia (UAE)) **The effects of mercurial preservatives on ocular tissues.** ***Fed. Proc. Fed. Am. Soc. Exp. Biol.*** 40(3PT1): 676; 1981.

Studies by various investigators have alluded to the fact that preservatives such as phenylmercuric nitrate (PMN) or acetate (PMA) could be responsible for the development of Band Keratopathy in glaucomatous pa-

tients. Treatment with thiomerosal, however, showed no effects. Based on these reports the possibility of PMN interaction with corneal metabolism versus the effects of thiomerosal was investigated. Normal rabbits and animals with induced unveitis and glaucoma were used. Preliminary results indicate that 1% PMN caused corneal edema, pannus and iritis in those animals with induced disease, whereas no effects were elicited in the normal animals or those treated with thiomerosal for a duration of one month of continuous treatment (5 times/day). Thus there appears to be a positive correlation between the chronic use of PMN and effects on corneal metabolism. [Abstract # 2554.] (Author abstract by permission)

81-1690. Karl, P. I.; Yarbrough, J. D. (Mississippi State Univ., Mississippi State, MS 39762) **Biochemical alterations in mirex-induced liver enlargement.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 676; 1981.

A single oral dose of mirex [100 mg/kg body wt (BW)] to rats increased liver mass by 2-fold in 4 days. In this mirex-induced liver enlargement, there were increases in liver protein (control = 883 ± 20, test = 1516 ± 48 mg/100 g BW) and RNA (control = 25 ± 1, test = 44 ± 5 mg/100 g BW). Total liver DNA remained unchanged indicating that the enlargement was due to cellular hypertrophy. Based on DNA synthesis, in partially hepatectomized (pHTX) rats challenged with mirex, the regenerative process progressed without alteration. However, accelerated increases in liver mass were observed (control = 6.56 ± 0.14, test = 8.45 ± 0.45 g/100 g BW). In mirex treated pHTX rats, liver ornithine decarboxylase activity increased. Adrenalectomy had no effect on ornithine decarboxylase levels in either mirex treated intact or mirex treated pHTX rats. [Abstract # 2557.] (Author abstract by permission)

81-1691. Mehrotra, B. D.; Philips, N. G.; Desaiah, D. (Dep. Chem., Tougaloo Coll., Jackson, MS 39216) **Comparative effects of chlordecone on ATPases of different subcellular fractions in rat brain.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 677; 1981.

Chlordecone (C) is a chlorinated hydrocarbon pesticide which has been shown to inhibit different ATPases in various tissues. The present studies were initiated to compare the sensitivity of ATPases of various subcellular fractions of rat brain to C. Mitochondrial (M), microsomal (MR), myelin (ML) and synaptosomal (S) fractions were utilized to determine Na^+,K^+, oligomycin-sensitive (O-S) and insensitive (O-I) Mg^{2+}-ATPases. The inhibition of Na^+,K^+-ATPase activity by C *in vitro* in MR and S fractions was identical with an IC50 of 6 μM. The enzyme activity in these fractions was inhibited in a concentration-dependent manner. However, ML and M fractions did not show a concentration-dependent inhibition. O-S, Mg^{2+}-ATPase activity in all the fractions was inhibited in a concentration-dependent manner. The IC50 values for M, MR and S were 1.8, 1.8, 2.4 and 2.4, respectively. O-I,Mg^{2+}-ATPase was not significantly effected by C in any fraction used. Na^+,K^+-ATPase in S fraction was the most sensitive to C followed by MR > M > ML. O-S,Mg^{2+}-ATPase in M fraction was the most sensitive enzyme to C followed by MR > S > ML. These results suggest that C exerts differential effects on ATPase in the same tissue. The reason may be due to the lipid composition of each fraction since C is a lipophilic compound. [Abstract # 2558.] (Author abstract by permission)

81-1692. Squibb, R. E., Jr.; Tilson, H. A. (NIEHS, Research Triangle Park, NC 27709) **Perinatal exposure to Kepone (K) produces long-term neurobehavioral changes in rats.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 677; 1981.

Pregnant Fischer 344 rats were exposed during gestation and the first 12 days of lactation to 1 or 6 ppm Kepone (chlordecone; K) via the diet. There were no effects of K on maternal wt gain; the birth wt, litter size, and sex ratio of the litter were also unaffected by K. The offspring were weighed and assessed in a battery of neurobehavioral tests at 30 and 100 days of age. At 30 days of age, the K-exposed rats did not differ from controls with regard to body wt, negative geotaxis latencies, grip strength, startle responsiveness, motor activity, or tail flick latencies. At 100 days of age, the only effects noted were increased negative geotaxis latencies in K-exposed males (164% of control); rats of both sexes had decreased body wt (70-80% controls). In subsequent studies, K-exposed rats were found to be as sensitive as controls to the motor activity stimulating effects of 2 mg/kg of *d*-amphetamine. However, male rats exposed to K were found to exhibit significantly more apomorphine (1 mg/kg)-induced hypermotility than controls (171% of control). These data suggest that perinatal exposure to K can produce long-term alterations in dopaminergic function. [Abstract # 2559.] (Author abstract by permission)

81-1693. Crump, D.; Gwebu, E. T. (Oakwood Coll., Huntsville, AL 35806) **Inhibition of human platelet aggregation by DDT.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 677; 1981 (1 reference).

A problem of immediate concern is the health effects of DDT among Triana residents in North Alabama. These residents have been drinking water and eating fish from local rivers contaminated with DDT for over 30 yr. The Centers for Disease Control performed tests on 12 Triana residents and found an average DDT level that was 4 times (0.22 ppm) higher than normal. These findings prompted an examination of the effect of DDT on platelet function. Blood was collected from healthy non-Triana residents and anticoagulated with sodium citrate. Methanolic 1,1-*bis*(*p*-chlorophenyl) -2,2,2-trichloroethane

(DDT) was added to the blood (2.3 ppm) and the mixture was allowed to stand at room temperature for 2.5 hr. Control experiments contained methanol. Platelet rich plasma (PRP) was prepared according to the procedure of Panganamala. Platelet aggregation (PA) was induced by 40 μM ADP and monitored for 2.5 min at 37°C. In control experiments PA was 77 ± 6% while in DDT-treated samples it was 46 ± 13%. These results show that platelets from DDT-treated blood aggregated to a significantly lesser extent than platelets from control ($p < 0.001$). Although concentration of DDT used was approximately 10 times higher than that found in Triana residents, long-term effects of this pesticide may be comparable to the results of this study. [Abstract # 2560.] (Author abstract by permission)

81-1694. Leighty, E. G.; Fentiman, A. F., Jr. (Battelle Columbus Lab., Columbus, OH 43201) **Liver microsomal conjugation of pentachlorophenol to fatty acids.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 677; 1981.

The hydroxylated toxic environmental pollutant pentachlorophenol was found to conjugate to fatty acids in an *in vitro* rat liver coenzyme A fortified microsomal system. It was previously shown that a hydroxylated metabolite of DDT was also conjugated to fatty acids in the *in vitro* system and that these fatty acid conjugates of DDT were also retained *in vivo* in livers and spleens of rats given DDT. The phenomenon of fatty acid conjugation to toxic chemicals may be the mechanism by which the compounds are retained in tissue of animals. The liver coenzyme A fortified microsomal system might also be used as an *in vitro* method to evaluate whether certain chemicals might be expected to be retained in fat-containing tissues and ultimately exert a toxic effect. [Abstract # 2561.] (Author abstract by permission)

81-1695. Witkin, J. M.; Leander, J. D. (Dep. Pharmacol., Sch. Med., Univ. North Carolina, Chapel Hill, NC 27514) **Effects of chlordimeform, a formamidine pesticide, on food and water consumption and punished behavior of rats: comparison with chlordiazepoxide.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 677; 1981.

Chlordimeform (CDF, *N'*-(4-chloro-*o*-tolyl)-*N,N*-dimethylformamidine) and chlordiazepoxide (CDAP) were administered ip in doses of 1.25-40.0 mg/kg 30 min prior to a 1 hr period of access to food or water. Both compounds (2.5-10.0 mg/kg) increased food intake of non-food-deprived rats. Typical of compounds which increase food intake, CDAP (2.5-10.0 mg/kg) increased water consumption of 23 hr water-deprived rats; CDF only produced dose-related decreases. *d*-Amphetamine (0.1-3.0 mg/kg, ip) decreased both food and water intake. Combinations of CDAP and CDF produced effects on water intake which were similar to those produced by either drug alone. Tolerance developed to effects of CDF on water intake when 20.0 mg/kg CDF was administered daily prior to drinking and to a lesser extent when it was administered after drinking. Tolerance was reversed after 9 days during which CDF was not given. Drinking suppressed (punished) by quinine adulteration of the water and food-maintained behavior punished by electric shock presentation were increased by CDAP (2.5-20.0 mg/kg) but not by CDF. The results suggest that CDF possesses novel pharmacological properties in that its effects on food intake are opposite to its effects on water intake and punished behavior. [Abstract # 2562.] (Author abstract by permission)

81-1696. McPhail, R. C.; Gordon, W. A.; Johnston, M. A. (Neurotoxicol. Div., US EPA, Research Triangle Park, NC 27711) **Behavioral effects of a synthetic pyrethroid insecticide (decamethrin).** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 678; 1981.

The effects of decamethrin were studied on rats' performance under a schedule that arranged milk delivery after every 40 lever presses. Baseline performance was characterizeed by a brief pause after milk delivery followed by a rapid rate of responding until the next milk delivery. Decamethrin (1-8 mg/kg body wt, po, 2-hr pre-session) produced both dosage-related increases in pause duration and decreases in response rate. Decamethrin was also studied using a conditioned-flavor- aversion paradigm in which rats were first acclimated to water availability for 30 min/day. When intakes had stabilized, saccharin solution (0.1% w/v) was substituted for water and 30-min after availability rats received either a dosage of decamethrin (1-8 mg/kg, po), the corn-oil vehicle (1 ml/kg) or no treatment. Water alone was available for the next 3 daily sessions. In session 3 water and saccharin were concurrently available. Decamethrin-treated rats displayed an aversion to saccharin that was maximal at 2 mg/kg. Vehicle effects and position biases were identified as potential confounding procedural variables. In both series of experiments, behavioral effects were obtained at a dosage (2 mg/kg) that represents approximately 1.4%-3.8% of the reported LD50 values (52-140 mg/kg). [Abstract # 2569.] (Author abstract by permission)

81-1697. Covell, D.; Abbrecht, P.; Berman, M. (US NIH, Bethesda, MD 20215) **The role of hepatic warfarin binding in dose-dependent plasma warfarin clearance.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 685; 1981.

The oral anticoagulant, sodium warfarin, exhibits dose-dependent pharmacokinetics. A mechanism for the inverse relationship between dose and total plasma warfarin clearance remains unclear. It was hypothesized that the saturation of hepatic tissue warfarin binding sites might contribute to the reduction in total plasma warfarin clearance. To test this hypothesis, normal and functionally hepatectomized rats were given a 0.01, 0.10 or 1.0 mg/kg dose of sodium warfarin and plasma radioactivity was serially measured for 60 min. In the intact rats biliary

radioactivity during the experiment and total hepatic radioactivity at the end of the experiment were also measured. Kinetic analysis of the results revealed that extra-hepatic tissue warfarin binding played a relatively minor role in dose-dependent warfarin clearance. However, hepatic warfarin uptake, which was also dose-dependent, correlated well with the dose-dependent changes in plasma warfarin clearance. [Abstract # 2607.] (Author abstract by permission)

81-1698. Somani, S. M.; Kaka, J. S.; Smart, T. A. (Dep. Pharm., Sch. Med., South. Illinois Univ., Springfield, IL 62702) **Disposition of 2,4-dimethylphenol and 2,4-dichlorophenol in rat.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 698; 1981.

2,4-Dimethylphenol (2,4-DMP) and 2,4-dichlorophenol (2,4-DCP) appear to be consistently present in tap water and industrial effluents. Their disposition in animals has not been investigated. A gas chromatographic method was developed to assay 2,4-DMP and 2,4-DCP in biological tissues. The metabolism and disposition of these 2 pollutants in rat tissues were studied. Groups of 3 or 4 rats were administered 2,4-DMP by iv infusion (17 mg/kg) for 6 hr. Animals were sacrificed by cardiac puncture at various time intervals; brain, liver and fat were removed, and 2,4-DMP was quantitatively determined. Brain accumulated the highest amount on a per g basis, followed by fat and liver. The ratios of brain, liver and fat to plasma were approximately 3, 1.5 and 2, respectively. 2,4-DMP distributed rapidly through the body after iv bolus administration (30 mg/kg). Plasma, liver and fat concentrations disappeared prior to 60 min, whereas 2,4-DMP persisted in the brain. Conjugated 2,4-DMP was about 70 times and 16 times the free compound, at 30 min after iv and ip administrations respectively. 2,4-DCP appeared to be completely in the conjugated form (glucuronide 51% and other conjugates 49%) in the plasma 30 min after iv administration (10 mg/kg). The kidney had the highest concentration of free compound (8.5 μg/g) followed by the liver (1.56 μg/g) and the fat (0.8 μg/g) after 30 min. [Abstract # 2676.] (Author abstract by permission)

81-1699. Kingsley, B. S.; Hitchcock, M. (John B. Pierce Foundn., New Haven, CT 06519) **Age differences in the *in vivo* and *in vitro* effects of 1,2,4-trichlorobenzene (1,2,4-TCB) on hepatic microsomal metabolism in rats.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 698; 1981.

The effects of 1,2,4-TCB (a degradation product of the widely used insecticide benzene hexachloride; BHC) and 3-methylcholanthrene (3MC) on hepatic microsomal metabolism were compared *in vivo* by zoxazolamine paralysis time (ZPT) and *in vitro* by aniline hydroxylase activity (AH) and cytochrome P-450 levels (Cyt. P-450) in male rats aged 23 (A) and 63 (B) days. Single ip doses (110-860 μmol/kg 1,2,4-TCB and 4-100 μmol/kg 3MC) were given 24 hr prior to *in vivo* experiments and sacrifice. Age differences in sensitivity to 1,2,4-TCB were observed. In (A), doses of 1,2,4-TCB (μmol/kg) required to produce 50% maximum effect on ZPT, AH and Cyt. P-450 were, respectively: 210, 100 and 130; in (B), the doses required were, respectively; 330, 270 and 270. While no differences in body wt, liver wt or liver/body wt ratio (L/B) were found between control and treated rats in group (B), all doses of 1,2,4-TCB caused significant increases in liver wt and L/B ratio in group (A). 3MC was more effective than 1,2,4-TCB *in vivo*; doses for 50% maximum effect on ZPT in (A) and (B) were 5.6 and 10 μmol/kg, respectively. However, 100 μmol/kg 3MC produced AH activity equivalent only to 50% maximal induction elicited by 1,2,4-TCB. These data illustrate the importance of age in the evaluation of the response to environmental agents. [Abstract # 2677.] (Author abstract by permission)

81-1700. Moody, D. E.; Woo, C. H.; Smuckler, E. A. (Dep. Pathol., Univ. California, San Francisco, CA 94143) **Cytochrome P-450 lowering effect of 1,2-dibromo-3-chloropropane and carbon tetrachloride.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 699; 1981.

After carbon tetrachloride (CCl_4), 1,2-dibromo-3-chloropropane (DBCP), ethylene dibromide (EDB), and epichlorhydrin (EPI) were given to male rats, hepatic microsomal cytochrome P-450 values were 76, 54, 57, and 78% of controls at 48 hr, respectively. While DBCP, EDB, and EPI effected a linear loss, CCl_4 effected a biphasic loss, with 50% of the maximal loss within 4 hr and an increase in diene conjugates at 1 hr. P-450 was also reduced in microsomes from kidney, lung, testis, and small intestine mucosa of animals treated with CCl_4, DBCP, EDB, and EPI. As studied in kidney and testis, the early loss of P-450 was still apparent, but was not accompanied by an induction of diene conjugates. P-450 was also decreased in both rough and smooth microsomes, detergent extracts of nuclei, and nuclear membranes, but not in mitochondrial fractions after CCl_4 and DBCP. The loss of hepatic microsomal P-450 was accompanied by a decrease in the dealkylation of 7-ethoxy-coumarin, benzphetamine, and dimethylaniline to 1, 7, and 37% and 15, 36, and 39% of controls after CCl_4 and DBCP, respectively. A decrease in the density of 2 of the 3 major peaks (MW 45-60,000 Dal) was seen in microsomal proteins from animals treated with DBCP and CCl_4. These results suggest that while alkyl halides with low halocarbon bond dissociation energies display a unique mechanism, the organ independent loss of microsomal P-450 is a general response to alkyl halide intoxication. [Abstract # 2682.] (Author abstract by permission)

81-1701. Headley, D. B.; Lambrecht, R. W.; Erturk, E.; Peters, H. A.; Morris, C. R.; Bryan, G. T. (Cent. Health Sci., Univ. Wisconsin, Madison, WI)

Neuropathology and tissue levels of hexachlorobenzene (HCB) fed to rats, mice and hamsters. *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 699; 1981.

An epidemic of hexachlorobenzene (HCB) toxicity observed in Turkey during the 1950's was characterized by neurological disorders, dermatological lesions, and porphyria. This study was designed to correlate the neurologic lesions with tissue levels of HCB. Male (M) and female (F) Sprague-Dawley rats (SDR) and Syrian golden hamsters (SGH) fed diets containing 0, 200, or 400 ppm HCB, and Swiss mice (SM) of both sexes fed diets of 0, 100, 0r 200 ppm HCB for 13 wk were fed unmedicated control diet until wk 53. Weight gains in HCB-fed animals were similar to the respective controls. Animals (25) in each group were killed at wk 13, and 3 animals were killed from each group every 6 wk thereafter. Tissue samples were examined both microscopically and chemically. Highest concentrations of HCB were in the fatty tissues of F, although M exhibited the more severe lesions. Brain-HCB concentrations (ppm) at 13 wk were: 64 M-SDR, 83 F-SDR, 42 M-SM, 66 F-SM, 58 M-SCH, and 70 F-SGH. All 3 species exhibited similar neurologic lesions (hyperemia, edema, arborization and hemorrhages in brain and meninges). These lesions extended to the cerebrum, cerebellum, medulla, spinal cord, and their meninges. The severity of the lesions were both sex- and dose-dependent. [Abstract # 2686.] (Author abstract by permission)

81-1702. Harry, G. J.; Tilson, H. A. (NIEHS, Research Triangle Park, NC 27709) **Post-natal triethyl tin (TET) affects dopaminergic (DA) function of rats when tested as adults.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 700; 1981.

Offspring of time-bred Fischer 344 rats were randomly fostered to dams resulting in 4 pups of each sex/litter. On day 5 postpartum, the pups were dosed sc with distilled water, 15% ethanol (ETOH) or 1.5 or 3 mg/kg triethyl tin (TET). At ~ 90 days of age, animals having received 3 mg/kg TET or ETOH were tested for their responsiveness to apomorphine (A), a dopamine receptor agonist. Rats representative of 14 separate litters were found to have an exaggerated response to the hypermotility produced by 1 mg/kg A as measured by an automated activity monitor. No differences between TET-exposed and ETOH rats were observed after 0.1 mg/kg A. Rats from 10 separate litters were found to be hypersensitive to the stereotypic effects of 1 mg/kg A as measured by an observational rating scale. In another study, postnatally exposed rats were trained as adults (N = 10 litters) to make a lever touch response on a Variable Interval (VI) 15 sec schedule of food reinforcement. The behavioral suppressant effects of A (0.013-0.125 mg/kg, sc) and aerocline (0.3-2.4 mg/kg, sc) were determined. No differences in dose response curves were observed in the TET-exposed animals as compared to ETOH controls. No differences in body wt were observed in any of the studies. These data indicate that postnatal exposure to TET produces long-term alterations in DA function. However, the effect may be test dependent or related to the dose of apomorphine used as the pharmacological challenge. [Abstract # 2689.] (Author abstract by permission)

81-1703. Miller, D. S.; Russell, D. B.; Holliday, C. W. (Mt. Desert Island Biol. Lab., Salsbury Cove, ME 04672) **$HgCl_2$ inhibition of amino acid transport in hamster placental slices.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 714; 1981.

The mammalian placenta functions as a selective barrier to nutrients, ions, water, excretory products and toxicants, nourishing and protecting the developing fetus. Heavy metal compounds are both teratogenic and fetotoxic; they accumulate in placental tissue and cross the maternal-fetal barrier. The effects of these toxicants on placental function have not been investigated in detail. Present here are the results of initial experiments on the effects of $HgCl_2$ on L-leucine transport in hamster placental slices. In control slices, 10 μM leucine was accumulated by a carrier mediated process that was inhibitable by L-isoleucine, but was not dependent on medium Na or oxidative metabolism, and an isoleucine insensitive process that appeared to be nonmediated. Slices exposed to 0.01-1 mM $HgCl_2$ for 1-30 min exhibited inhibition of uptakes that increased with increasing Hg concentration and exposure time; only the carrier mediated component of transport was affected. With 1 min exposures, the I50 value (concentration of toxicant causing 50% inhibition of mediated transport) was about 0.01 mM Limited experiments with $CdCl_2$ indicated that this metal salt also inhibited leucine transport, but was 2 orders of magnitude less potent than $HgCl_2$. These *in vitro* dosing studies indicate that one or more specific transport proteins for essential amino acids are sensitive sites of heavy metal salt action in placental tissue. [Abstract # 2762.] (Author abstract by permission)

81-1704. Cherian, M. G. (Dep. Pathol., Univ. West. Ontario, London, Ontario N6A 5C1, Canada) **Comparative studies on mechanism of cellular toxicity of cadmium. Metallothionein and cadmium chloride in rat kidney epithelial cell culture.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 714; 1981 (2 references).

The isolated rat liver cadmium-metallothionein (Cd-Mt) is a potent nephrotoxin and is more toxic than Cd salts *in vivo*. It is not yet understood whether the enhanced toxicity of Cd-Mt is due to the complex itself or Cd^{++} ions released from it. The cellular toxicity of these compounds was compared after direct addition to control rat kidney epithelial cell mono-layer cultures and also to cells containing Mt after pretreatment with $CdCl_2$ (10^{-5} M Cd). Cells were grown in D-Valine MEM to confluency and Cd^{++} (10^{-6} to 10^{-2} M) as $CdCl_2$ or Cd-Mt were added to the media. The cellular damage was measured by morphology and also by ^{3}H-deoxy glucose release to media. The reduced cellular

colonies, cell detachment and disrupted cells were screened microscopically and considered as toxic effects. The release of deoxy glucose from the cell was a more sensitive marker of membrane leakage than the morphology. Cd-Mt was 8 times more toxic than $CdCl_2$ when added to renal cell cultures. When the monolayer primary cultures were pretreated with $CdCl_2$ (10^{-5} *M*) for 24 hr before addition of the compounds, there was protection against toxicity of $CdCl_2$ (10^{-4} *M* Cd) but not against Cd-Mt (10^{-5} *M* Cd) toxicity. These results suggest that the mechanisms of cellular toxicity of $CdCl_2$ and Cd-Mt are different, and Cd-Mt complex itself may be the toxic agent. [Abstract # 2767.] (Author abstract by permission)

81-1705. Oberdoerster, G.; Hochrainer, D. (Med. Cent., Univ. Rochester, Rochester, NY 14642) **Differences in alveolar clearance of iron oxide and cadmium chloride aerosols.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 715; 1981.

In acute inhalation experiments no significant differences in alveolar clearance half lives of different Cd compounds and inert particles had been found, which may suggest similar clearance pathways. As Cd can affect pulmonary macrophage function and ciliary function, this effect on lung clearance mechanism should be measurable *in vivo*. Thus, if Cd and inert particles are cleared by the same alveolar clearance mechanism this should become apparent after Cd pre-exposure. Two groups of rats were exposed to CdO aerosols for 16 wk (10 $\mu g/m^3$). This exposure was interrupted after 6 wk for a 1 hr exposure to $^{59}Fe_2O_3$ or $^{115}mCdCl_2$. Two groups of control animals received only the 1 hr exposure. Lung clearance of both isotopes was followed up by serially sacrificing 5 animals each at different time intervals. It was found that $^{59}Fe_2O_3$ clearance was significantly slowed down after CdO pre-exposure, whereas $CdCl_2$ clearance was not significantly different. These results indicate that Cd is cleared by different alveolar mechanisms than inert particles. Binding of Cd to protein is a likely explanation, and induction of metallothionein in the lung in chronic Cd exposure could explain the observed differences. It would also explain the agreeing lung clearance half lives of different Cd compounds. [Abstract # 2771.] (Author abstract by permission)

81-1706. Eckerson, H. W.; Wyte, C. M.; La Du, B. N. (Dep. Pharmacol., Univ. Michigan, Ann Arbor, MI 48109) **Pharmacogenetic studies on human serum paraoxonase: relative paraoxonase arylesterase activities.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 724; 1981 (1 reference).

Paraoxon, the organophosphate metabolite of parathion, is hydrolytically inactivated by paraoxonase, an arylesterase in serum. The level of human serum paraoxonase is a genetic, biomodally distributed, polymorphic trait, determined by 2 autosomal alleles at a single locus. In contrast, the rate of phenylacetate hydrolysis in serum (arylesterase activity) is unimodally distributed. Although it has a high heritability index, it does not depend upon 1 or 2 genes. These 2 activities comigrate in zymograms and on chromatography, and it seemed likely that both activities might be properties of 2 isozymic esterases, and the ratio of these different substrate activities be a further indication of qualitative differences in the allelic products. We found that when individual ratios of activity using paraoxon (in the presence of 1 *M* NaCl) and phenylacetate as substrates were analyzed in over 200 individuals the resulting values were trimodally distributed. The ratio of activities ± S.D. were: 0.79 ± 0.12; 3.02 ± 0.52; and 5.97 ± 0.60. Pedigree analysis shows the latter to be inherited as a co-dominant trait determined by 2 alleles at 1 autosomal locus. Thus, the substrate activity ratio can be used to classify individuals into 1 of the 3 paraoxonase/arylesterase genotypes. [Abstract # 2820.] (Author abstract by permission)

81-1707. O'Reilly, R. A. (Dep. Med., Santa Clara Valley Med. Cent., San Jose, CA) **Stereoselective interaction of sulfinpyrazone with racemic warfarin and its separated enantiomorphs in man.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 735; 1981.

Although serious hemorrhage during the therapeutic co-administration of sulfinpyrazone and racemic warfarin has been reported, no prospective studies have been performed. Thus, 6 normal subjects received single oral doses of racemic warfarin, 1.5 mg/kg body wt, with and without sulfinpyrazone, 400 mg orally daily, beginning 3 days before the warfarin dose and daily thereafter for the duration of the hypoprothrombinemia, about 9 days. Daily samples of venous blood were obtained for one-stage prothrombin times (Quick) and warfarin concentrations (HPLC). There was a significant augmentation both of the hypoprothrombinemia ($P < 0.001$) and the warfarin concentrations ($P < 0.05$). To determine whether this interaction was stereoselective, the same experiments were repeated in the same subjects with R- and S-warfarin enantiomorphs. With S-warfarin there was a highly significant augmentation both of the hypoprothrombinemia ($P < 0.001$) and the warfarin concentrations ($P < 0.001$), but with R-warfarin no significant changes were found. It was concluded that sulfinpyrazone augments the hypoprothrombinemia of racemic warfarin stereoselectively by reduced metabolic clearance of S-warfarin. The lack of interaction with R-warfarin suggests that it may be less dangerous for long-term therapy than racemic warfarin. [Abstract # 2885.] (Author abstract by permission)

81-1708. Drummond, L.; Bansal, S. K.; Desaiah, D. (Div. Sci. & Technol., M. I. Coll., Holly Springs, MS 38635) **Effect of chlordecone on ATPase activities in rat myocardial cell cultures.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 737; 1981.

Cell culture techniques have been used in the past

to assess the effect of environmental chemicals. The present investigation was initiated to determine the sensitivity of ATPase activities in rat myocardial cells (RMC) grown in monolayer cultures to chlordecone (C) since C was shown to be a potent inhibitor of cardiac muscle ATPases. Heart cells from 3-4 day old Sprague-Dawley rats were used. Critical aspects in the culture include aseptic techniques, gentle trypsinization and plating density. Each rat heart yielded 1×10^6 cells of which 80-90% were trypan blue negative. Cells were plated in a 25 cm square flask at a density of 3×10^6 cells/flask in minimum essential medium (Eagle) supplemented with 10% new born calf serum. Whenever C was used, the cells were preincubated with 5 and 10 μM C for 1, 6, 12, 24, 48 and 72 hr. Cell fractionation was done by centrifugation and the pellet obtained at 13,000 × g was used as the enzyme source. C inhibited Na^+-K^+ and mitochondrial Mg^{2+} ATPase (M Mg^{2+} ATPase) *in vitro* in a dose-dependent manner with an IC50 of 10^{-7} *M*. When the RMC were preincubated with C both Na^+-K^+ and M Mg^{2+}ATPases were significantly reduced at all time periods. The reduction was dose-dependent but not time-dependent. These results are indicative of C toxicity to RMC ATPases. [Abstract # 2895.] (Author abstract by permission)

81-1709. Ruebner, B. H.; Meierhenry, E. F.; French, S. W. (Dep. Pathol., Sch. Med., Univ. California, Davis, CA 95616) **Mallory bodies in hepatic tumors of mice induced by dieldrin.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 744; 1981.

Mallory bodies (MBs) were observed in hepatic nodules induced by long term administration of a diet containing 10 ppm dieldrin to 171 C57, C3H, or C57/C3HF1 mice. MBs were seen in 73 of 114 mice which developed hepatic nodules, including 53 of 66 mice with hepatocellular carcinoma. The MBs were confined primarily to tumor tissue and persisted in carcinoma transplanted into nude mice. MBs were not observed in 174 mice given diethylnitrosamine including 68 with hepatic nodules. In 174 control mice, MBs were seen in 1 of 20 mice with hepatic nodules. These observations suggest that MBs may be a marker for neoplastic transformation in mice treated with dieldrin and may prove useful in the study of hepatic carcinogenesis. [Abstract # 2938.] (Author abstract by permission)

81-1710. Erturk, E.; Grunden, E. E.; Bryan, G. T. (Clin. Sci. Cent., Univ. Wisconsin, Madison, WI 53792) **Subchronic toxicity of hexachlorobenzene (HCB) in rats, mice, and hamsters.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 745; 1981.

HCB is a major by-product of polychlorinated hydrocarbon synthesis; was used in the past as a fungicide; and was linked to acute mortality and chronic porphyria in persons residing in southeastern Turkey who accidentally ingested it during the 1950's. It was evaluated for subchronic toxicity (91 days) in male (M) and female (F) Sprague-Dawley rats (R), Swiss mice (SM), and Syrian golden hamsters (H) by feeding at 2 dosages in ground Wayne Lab Blox. Maximal cumulative dosages (mmol) ingested/animal were: 200 ppm - MR 1.4; FR 1.0; 400 ppm - MR 3.0; FR 2.2; 100 ppm - MSM and FSM 0.2; 200 ppm - MSM and FSM 0.4; 200 ppm - MH and FH 0.6; 400 ppm - MH 1.2; FH 1.4. Growth rate of any treatment group did not differ significantly from the respective controls. Necropsy showed more prominent lesions in males and included marked hepatosplenomegaly, and congestion in the gastrointestinal tract and in all other abdominal and thoracic organs. Thymuses and lymph nodes were usually enlarged. Histologic examinations revealed congestion and microhemorrhages in the central nervous system; degenerative and precirrhotic changes in the liver; and hyperplastic lymphocytic proliferations in the thymuses, and other lymphoreticular centers; and infiltrates into livers. [Abstract # 2940.] (Author abstract by permission)

81-1711. Boroujerdi, M.; Anderson, M. W. (Coll. Pharm., Dalhousie, Univ., Dalhousie, Nova Scotia B3H 3J5, Canada) **Effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) and butylated hydroxyanisole (BHA) on the enzymatic conjugation of benzo(a)pyrene (BP) metabolites.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 745; 1981.

It has been suggested that antioxidants such as BHA and some inducers of microsomal arylhydrocarbon hydroxylase (AHH) such as TCDD might exert their anticarcinogenic effects, at least in part, by affecting the activities of glutathione s-transferase (GST) and UDP glucuronosyltransferase (GCT) respectively. We have examined changes in the formation of glucuronide (GC), sulfate (S) and glutathion (GSH) conjugates of BP in animals pretreated with BHA or TCDD. Rats were fed a diet for 2 wk containing 0.75% BHA. For animals pretreated with TCDD, the inducer was administered (50 nmol/kg in 0.3 ml/kg dioxane, IP) 4 days prior to 3H-BP administration. Animals were bile-cannulated and BP was administered IV by the femoral vein. Samples of bile were analyzed directly for conjugates by ion paired chromatography using radial compression column. The total rate of biliary excretion was similar in treated and controls with approximately 68% of the dose being excreted in 6 hr. BHA or TCDD pretreatment had caused no significant increase in GC, S or GSH conjugation. These findings indicate that induction of GST or GCT are not an important factor in the anticarcinogenic action of BHA or TCDD toward BP. [Abstract # 2944.] (Author abstract by permission)

81-1712. Chowdhury, P.; Rayford, P. L. (Dep. Physiol. Biophys., Univ. Arkansas Med. Sci., Little Rock, AR 72205) **Influence of cadmium ($CdCl_2$) on the plasma an-**

titryptic activity (TIC) of mice. *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT1): 792; 1981.

Chronic exposure to cadmium has been implicated in pulmonary emphysema which is associated with severe α_1-antitrypsin deficiency. Whether the development of emphysema in industrial workers chronically exposed to cadmium is a phenomenon of cadmium-α_1-antitrypsin reaction is not known. This study was conducted to determine the effects of a single dose of cadmium on plasma TIC and lung tissue of mice. Sixty CFW mice were divided into 12 groups containing 5 mice/group. Each mouse received 0.2 ml sc injection of cadmium (13.8 mg/kg) or saline and sacrificed before and at 1, 2, 4 and 24 hr after injection. Blood samples were collected for measurement of TIC by enzymatic methods and for cadmium levels by spectrophotometric methods. Lung tissues were examined using light microscopy. After cadmium TIC decreased from 100% to 79% at 4 hr and was 93% at 24 hr. One hr after exposure to cadmium there were gross morphological changes in lung tissue such as ruptured blood vessel and distended alveoli. The loss of anti-tryptic activity accompanied by morphologic changes in lung tissue in mice exposed to a single dose of cadmium support the concept that cadmium is involved in a protease-antiprotease imbalance and in changes in lung tissue similar to those seen in emphysema. Mice exposed chronically to cadmium might be a useful model in the study of pulmonary infections occurring as a result of antitrypsin deficiency. [Abstract # 3199.] (Author abstract by permission)

81-1713. Brown, P. I.; Rankin, G. O. (Dep. Anat., Sch. Med., Marshall Univ., Huntington, WV 25701) **Histological changes in renal tissue following acute administrations of *N*-(3,5-di-chlorophenyl)succinimide.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT2): 827; 1981.

The acute renal effects of the fungicide N-(3,5-dichlorophenyl) succinimide (dimethachlon; NDPS) were studied in male Sprague-Dawley rats (350-400 gm). After the rats received NDPS (50, 100, or 200 mg/kg, ip) or vehicle (sesame oil, 2.5 mg/kg, ip) for 24 or 48 hr respectively, they were killed by cervical dislocation. Kidneys were rapidly removed, fixed in 10% formalin, 1% $CdCl_2$, sectioned at 6-8 μm, and stained in hematoxylin and eosin and periodic acid-Schiff reactions. Pathological alterations followed a dose-dependent pattern in all kidneys exposed to NDPS. In each treatment group, the proximal convoluted tubules were most greatly affected as seen in epithelial atrophy and alterations in the tubular lumina (occluded by cellular debris in some areas; markedly dilated elsewhere surrounded by flattened epithelial cells). Upon administration of 100 and 200 mg/kg for 48 hr, some glomeruli fragmented while others remained intact and demonstrated profuse concentrations of red blood cells. Variations in thickness of tubular basal lamina were observed. Damage to distal convoluted tubules was noted only in the most severe dosage level. These results suggest that the acute administration of NDPS produces nephrotoxicity principally through its action on the proximal convoluted tubules. [Abstract # 3393.] (Author abstract by permission)

81-1714. Morrissey, R. E.; Mottet, N. K. (Dep. Pathol., Univ. Washington, Seattle, WA 98195) **Pathogenesis of arsenic-induced exencephaly in mice.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT2): 836; 1981.

Arsenic, a demonstrated teratogen in laboratory animals, is a common environmental contaminant. Among the anomalies produced by treatment of nulliparous females on day 7, 8, or 9 of pregnancy is exencephaly. To study the pathogenesis of this neural tube defect Balb/c mice were treated with sodium arsenate on day 8 of pregnancy (plug day = day 0) between 1300 and 1700 hr. Eighty five percent of the 45 mg/kg dose group were exencephalic, as judged by failure of the neural tube to close within 48 hr, and by examination of other fetuses on day 17. In electron micrographs the neuroepithelium contains necrotic cells which appear to have lost contact with adjacent cells, leading to gaps in the tissue. Supporting mesoderm also contains a few necrotic cells, as does the neuroepithelial transition zone (that region destined to meet the opposite neural fold and fuse). In scanning micrographs this transition zone is focally discontinuous in treated animals, which may result in nonfusion of the neural folds. [Abstract # 3442.] (Author abstract by permission)

81-1715. Hildebrandt, E.; Suttie, J. W. (Univ. Wisconsin, Madison, WI 53706) **Coumarin sensitivity of vitamin K-related enzymes in normal and warfarin-resistant rats.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT2): 873; 1981.

The *in vitro* effects of 2 coumarin anticoagulants, warfarin and difenacoum, on the microsomal vitamin KH_2-dependent carboxylase, vitamin KH_2-epoxidase, vitamin K-epoxide reductase, and cytosolic vitamin K reductase (DT-diaphorase) from the livers of normal and warfarin-resistant rats have been determined. Difenacoum is an effective anticoagulant in rats resistant to warfarin. High concentrations of both coumarins are required to inhibit the carboxylase and epoxidase activities in both strains of rats. The diaphorase is more sensitive to both inhibitors when assayed with dichlorophenolindophenol, but its sensitivity is reduced when assayed with vitamin K incorporated into liposomes. The diaphorases isolated from both strains of rats were equally sensitive. The epoxide reductase was the most sensitive of the enzymes studied. The normal rat enzyme is inhibited 50% by 2.5 μM warfarin. The resistant rat epoxide reductase is equally sensitive to difenacoum but requires over 50 μM warfarin for 50% inhibition. These results are in agreement with the response of normal and resistant rats to treatment with warfarin and difenacoum and support the hypothesis that the physiologically important site of action of coumarin

anticoagulants is the vitamin K-epoxide reductase. [Abstract # 3653.] (Author abstract by permission)

81-1716. Meydani, M.; Meydani, S.; Hathcock, J. N. (Iowa State Univ., Ames, IA 50011) **Effects of dietary methionine on toxicities of methylmercury and atrazine.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT2): 917; 1981.

The effects of dietary methionine on the toxicities of methylmercury hydroxide and atrazine were investigated. One-month-old male Wistar rats were fed diets (70, 100 or 130% of methionine requirement) and treated with atrazine (0 or 500 mg/kg diet), methylmercury (0, 0.5 or 1.5 mg Hg/kg/day) orally, or a combination of the 2 toxicants for 30 days. Blood, liver and kidney were assayed for glutathione peroxidase (GPx), total mercury, prostaglandin E_1 and thromboxin B_2 (TXB_2). Hind leg paralysis occurred with the higher Hg level and was exaggerated by atrazine. Low methionine increased Hg accumulation in tissues of Hg-treated rats. Atrazine had no effect on Hg in tissues, but low dietary methionine increased tissue Hg. Liver GPx activity increased with increasing dietary methionine and was lowered by Hg treatment. Hg and atrazine together did not lower liver GPx at the high dietary methionine level. Methionine had no effect on whole-blood GPx. Hg treatment lowered this activity but the effect was not influenced by atrazine. Hg and atrazine each increased serum PGE_1 and TXB_2. Dietary methionine of 70 and 130% of requirement elevated both PGE_1 and TXB_2 compared to the 100% control, perhaps indicating that either high or low dietary methionine is a stress. The high methionine level eliminated the toxic effects of the atrazine treatment and of the lower Hg dose but not the higher dose. This included restoration of normal wt gains in presence of the toxicants. [Abstract # 3901.] (Author abstract by permission)

81-1717. Neefe, J. R.; Sullivan, J. E. (Div. Immunol. Oncol., Georgetown Univ., Washington, DC 20007) **Clonal basis of HLA restriction in human cytotoxic responses to trinitrophenol (TNP)-modified autologous lymphocytes.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT2): 1000; 1981.

Human lymphocytes cytotoxic for TNP-modified cells preferentially kill HLA-matched targets. Substantial cross-reactive killing of HLA-unrelated targets is also seen. Experiments were designed to distinguish whether clones of killers absolutely restricted to targets sharing HLA antigens coexist with clones killing HLA unrelated targets or whether all clones kill both types of targets with varying efficiencies. Individual WK was primed to TNP-modified WK and frozen. Aliquots were thawed and seeded in microwells at various dilutions in the presence of new stimulators and crude T cell growth factor. After 7 days, 300 targets were added to each well for a 4 hr ^{51}Cr release cytotoxicity assay in which each well was tested against only 1 target. In other experiments, clones from wells seeded with 1 cell were tested against a panel of targets. Some clones killed TNP-modified targets sharing a particular HLA-A or -B antigen. Some clones killed only certain targets without relation to known HLA antigens. These data suggest that clones of TNP-specific killers are absolutely restricted to killing targets sharing specific surface antigens: HLA-A and -B in many, but not all, cases. Cross-reactive killing reflects the activities of clones whose restricting elements are distributed in the population in patterns different from that of HLA-A and -B antigens. [Abstract # 4366.] (Author abstract by permission)

81-1718. Clark, D. A.; Gauldie, J.; Sweeney, G.; Szewczuk, M. R. (Host Resistance Program, McMaster Univ., Hamilton, Ontario L8N 3Z5, Canada) **Selective suppression of cytotoxic T cell (CTL) generation by halogenated aromatic hydrocarbons.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 40(3PT2): 1096; 1981.

2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD) acts as a cumulative toxin that affects the immune system. We injected TCDD into C57Bl/6J male mice in 4 doses one wk apart. A 400 μg/kg total dose depleted cellularity in thymus, lymph nodes, and spleen, and the animals died. Forty μg/kg and 4 μg/kg caused depletion in thymus alone, and no atrophy was produced by 0.4 μg/kg. Nevertheless, at 0.4 μg/kg the percentage thy 1.2 + cells was reduced in lymph nodes and this was associated with impaired generation of CTL against alloantigens whereas the antibody response and delayed hypersensitivity response was unaffected. Limiting dilution assays showed normal or increased frequency of CTL precursors, and these CTLp developed normal amounts of CTL activity in microcultures in the presence of filler cells which provide help. In mass MLC tube cultures, the yield of CTL per CTLp was subnormal. This defect was detected with TCDD doses as low as 0.0004 μg/kg and correlated with increased suppressor cell activity in the thymus, and with induction of ethoxyresorufin-O-deethylase in the liver. CLT generation from CTLp was also impaired by the mixed PCB, Aroclor 1254 but not by the isomer 2,4,6,2′,4′,6′-hexachlorbiphenyl that lacks affinity for the *Ah* locus-controlled TCDD receptor that is present in thymus and liver. Halogenated aromatic hydrocarbons may affect T cell subsets and either decrease help or stimulate suppressor cells regulating CTL. [Abstract # 4918.] (Author abstract by permission)

81-1719. Smith, F. A.; Murray, F. J.; John, J. A.; Nitschke, K. D.; Kociba, R. J.; Schwetz, B. A. (Toxicol Res. Lab., Health & Environ. Sci., Dow Chem. USA, Midland, MI 48640) **Three-generation reproduction study of rats ingesting 2,4,5-trichlorophenoxyacetic acid in the diet.** *Food Cosmet. Toxicol.* 19(1): 41-45; 1981 (14 references).

Male and female, 4-6-wk-old Sprague-Dawley rats (F_0) were fed lab chow containing 2,4,5-T to provide dosage levels of 0, 3, 10 or 30 mg/kg/day for 90 days and were then bred. At day 21 of lactation, pups were randomly selected for the following generation (F_1) and the rest were autopsied. Subsequent matings were conducted to produce F_2, F_{3a} and F_{3b} litters, successive generations being fed after weaning on the appropriate test or control diet. Fertility was decreased in the matings for the F_{3b} litters in the group at the 10 mg/kg/day dose level. Postnatal survival was significantly decreased in the F_2 litters of the 10 mg/kg group and the F_1, F_2 and F_{3a} litters of the 30 mg/kg/day group. The relative liver wt of weanlings was significantly increased in the F_2, F_{3a} and F_{3b} litters of the 30 mg/kg/day group. A significant decrease in relative thymus wt was seen only in the F_{3b} generation of this dosage group. Thus, dose levels of 2,4,5-T that were sufficiently high to cause signs of toxicity in neonates had no effect on the reproductive capacity of rats, except for a tendency toward a reduction in postnatal survival at a dose level of 30 mg/kg/day. Reproduction was not impaired at the lowest dose level (3 mg/kg/day). (Author abstract by permission)

81-1720. Albrecht, R.; Pelissier, M. A.; Faudemay, F.; Dooh-Priso, E.; Carreau, J. P. (Lab. Biol., Conservatoire Natl. Arts & Metiers, U177, INSERM, F-75141 Paris, France) **Induction par le lindane des monoxygenases microsomales du foie chez le rat: effets d'un juene de 72 heures. [Induction by lindane of liver microsomal monooxygenases in rats: effects of a 72 hour fast.]** *Food Cosmet. Toxicol.* 19(1): 47-52; 1981 (29 references) (French).

Young male rats were divided into a control group and a group treated with lindane by addition of 60 ppm to the semi-synthetic diet for 4 wk. All the animals were then killed, half of each group after an 18-hr fast and the rest after a prolonged 72-hr fast. Ingestion of lindane accelerated the biotransformation of aminopyrine and of aniline by the liver microsomes and increased the *P*-450 content and the proportion of linoleic acid in the phosphatidylcholine. Prolonged fasting increased aniline hydroxylation and depressed aminopyrine demethylation. In lindane-treated rats, the fasting partly counteracted the induction of aminopyrine *N*-demethylase and of *P*-450 and completely supressed the characteristic effect of the pesticide on the linoleic acid content of the phosphoglyceride. It is suggested that lindane treatment leads to the induction of a particular form of *P*-450 sensitive to starvation and bound in the membrane to a phosphatidylcholine rich in linoleic acid. (Author abstract by permission)

81-1721. Desi, I. (Natl. Inst. Hyg., H-1966 Budapest, Hungary) **The effect of pesticides on the function of the nervous system.** *Gen. Pharmacol.* 12(2): A3; 1981.

The effects daily administration of subacute doses of chlorinated hydrocarbons, organophosphates, carbamates and phenoxyacetic acid pesticides to rats was studied. Emphasis was on central nervous system effects. Maze experiments were conducted daily. Electrocorticograms were registered at the conclusion of the experiment. Both the learning process and electric activity were affected rapidly by the low doses. Alterations in other biochemical laboratory parameters were not found. The chemicals tested were classified according to the direction, type and time of appearance of the observed changes.

81-1722. Boreiko, N. R. (N. I. Pirogov Med. Inst., Vinnitsa, USSR) **O vliyanii pestitsida despirolya na morfologiyu viutrennikh organov eksperimental'nykh zhivotnykh. [Effects of the pesticide Despirol on the morphology of internal organs of laboratory animals.]** *Gig. Sanit.* 45(12): 68-69; 1980 (1 reference) (Russian).

The effect of the organochlorine pesticide Despirol (kelevan; ENT 27154) on morphology of internal organs was studied in random bred albino rats. Animals were subjected to single administration at 280 mg/kg or to chronic administrations at 14 mg/kg for 4 mo, 2.8 mg/kg for 10 mo, or 0.28 mg/kg for 10 mo. After termination of the experiment, the animals were sacrificed and brain, lungs, myocardium and liver were examined. Both acute and chronic administrations of Despirol produced hyperemia of the internal organs and the brain, necrosis of the liver and kidneys, lymphoid infiltration in the walls of pulmonary alveoli and the interstitial tissue of the myocardium, liver and kidneys. The intensity of these changes depended upon the dose and duration of exposure. Since the changes observed after administration of Despirol at 0.28 mg/kg were reversible, this dose can be regarded as the threshold dose.

81-1723. Kuznetsov, V. G. (Author address not given) **Deistvie nekotorykh pestitsidov na psevdotuberkuleznye mikrov' *(Yersinia pseudotuberculosis)*. [Effect of some pesticides on pseudotuberculosis bacterium *(Yersinia pseudotuberculosis)*.]** *Gig. Sanit.* 46(1): 82-84; 1981 (16 references) (Russian).

The effects of 15 pesticides on *Yersinia pseudotuberculosis* were studied. Incubation of microbial cultures with pesticides at 10-400 μg/ml changed the reproduction and survival rates and the phenotypical variability of the test microorganism. The changes were the most pronounced after incubation with Granosan (ethylmercuric chloride) and zineb. Pesticides that are conducive to dissociation of *Y. pseudotuberculosis* into its R-form (thiazon, DDT, HCCH (BHC), zineb) are suggested to be ecological factors which favor the persistance of the pathogen in the environment.

81-1724. Anonymous **Rat poison diabetes.** *Hosp. Pract.* 16(3): 38-38; 1981 (3 references).

Severe insulinopenic diabetes mellitus has resulted from the ingestion of the rodenticide RH-787 (Vacor; pyriminil) by humans. The syndrome is characterized by marked insulinopenia without a reduction in glucagon levels. This suggests a specific β-cytotoxic effect, which is supported by evidence of pancreatic β-cell destruction. The rodenticide resembles streptozocin in its activity in that β-cell toxicity can be prevented by the *in vitro* addition of nicotinamide to the islets.

81-1725. Papst, M. H.; Boyer, M. G. (Freshwater Inst., Winnipeg, Manitoba R3T 2N6, Canada) **Effects of two organophosphorus insecticides on the chlorophyll *a* and pheopigment concentrations of standing ponds.** *Hydrobiologia* 69(3): 245-251; 1980 (14 references).

Chlorophyll *a* measurements were taken in an attempt to use them as an index of total phytoplankton, and to follow changes in biomass, in ponds treated with the organophosphorus insecticides Abate (temphos) and Dursban (chlorpyrifos). The results indicate that an increase in algal biomass is a predictable result of treatment of small ponds with these insecticides. The algal blooms in these experiments were composed of mixed planktonic forms, predominantly *Volvox aureus, Glenodinium* sp., *Kirchneriella contora, Ankistrodesmus falcatus, Dictyosphaerium* sp. and *Dinobryon* sp. The dominant macro-zooplankton in all ponds during the study was *Daphnia pulex.* A *Diaptomus* sp. was the second most abundant, but did not comprise more than 10% of the population at any time. Increases in chlorophyll *a* were noted 30-50 days after treatment; these levels greatly exceeded values obtained during the same time period in untreated ponds. The numbers of macro-zooplankton declined in all treated ponds, and generally remained low during the study. Pheopigment levels were not influenced by insecticide treatment, which suggests that organisms other than macro-zooplankton preyed on algae.

81-1726. Don, R. H.; Pemberton, J. M. (Dep. Microbiol., Univ. Queensland, St. Lucia, Queensland 4067, Australia) **Properties of six pesticide degradation plasmids isolated from *Alcaligenes paradoxus* and *Alcaligenes eutrophus.*** *J. Bacteriol.* 145(2): 681-686; 1981 (32 references).

A comparison is presented of the properties of 6 independently isolated plasmids encoding the degradation of 2,4-D and 4-chloro-2-methylphenoxyacetic acid (MCPA). The plasmids were isolated from *Alcaligenes eutrophus* and *Alcaligenes paradoxus*, since all or part of the degradation pathway for 2,4-D and MCPA is carried on conjugated plasmids in these strains. It was found that 4 of the plasmids, with molecular masses of 51 megadaltons, belonged to the IncP1 incompatibility group, and transferred freely to strains of *Escherichia coli, Rhodopseudomonas sphaeroides, Rhizobium* sp., *Agrobacterium tumefaciens, Pseudomonas putida, P. fluorescens*, and *Acinetobacter calcoaceticus.* These 4 plasmids conferred resistance to merbromin, phenylmercury acetate (PMA) and mercuric ions, and encoded degradation of *m*-chlorobenzoate. The other 2 plasmids isolated did not belong to the IncP1 incompatibility group, had molecular masses of 37 megadaltons, and encoded the degradation of phenoxyacetic acid. The results are discussed in terms of the possible use of genetic engineering techniques to degrade persistent environmental pollutants.

81-1727. Barnett, J. B.; Spyker-Cranmer, J. M.; Avery, D. L.; Hoberman, A. M. (Dep. Microbiol. & Immunol., Univ. Arkansas Med. Sci., Little Rock, AR 72201) **Immunocompetence over the lifespan of mice exposed *in utero* to carbofuran or diazinon. 1. Changes in serum immunoglobulin concentrations.** *J. Environ. Pathol. Toxicol.* 4(5-6): 53-63; 1980 (22 references).

Pregnant F_2 dihybrid females were exposed to anticholinesterase pesticides daily during gestation. Diazinon was administered at either 0.18 or 9.00 mg/kg maternal wt. Carbofuran was administered at 0.01 or 0.50 mg/kg/day. Immunological evaluations were carried out on the F_3 dihybrid outcross offspring of these F_2 mice. Mating F_2 dihybrid animals produced an F_3 outcross that was vigorous and well-buffered against spontaneous congenital deformities, but possessed a known genetic history and replicable gene pool. Mothers of pesticide and control groups gave birth to about equal numbers of offspring. F_3 offspring, whose mothers had been exposed to 9.00 mg/kg diazinon, suffered frequent respiratory infections. Moderate disturbances of serum concentrations of immunoglobulins were noted in mice from the exposed groups. Results suggest that prenatal exposure to pesticides which interfere with production of normal Ig concentrations may result in pronounced effects on IgM concentrations. Only transient effects were noted on post-natal IgG_1 and IgG_{2a} concentrations.

81-1728. Linder, R.; Scotti, T.; Goldstein, J.; McElroy, K. (Health Eff. Res. Lab., US EPA, Research Triangle Park, NC 27711) **Acute and subchronic toxicity of pentachlorobenzene.** *J. Environ. Pathol. Toxicol.* 4(5-6): 183-196; 1980 (31 references).

Pentachlorobenzene (QCB) occurs as a contaminant of the fungicides pentachloronitrobenzene (quintozene) and hexachlorobenzene, and is a metabolite of hexachlorobenzene and the insecticide lindane. The median lethal dose values for QCB in rats were calculated to be 1125, 1080 and 940 mg/kg po for adult males, adult females and weanling females, respectively. Similar values for mice were 1175 mg/kg for males and 1370 mg/kg for females. Tremors and narcosis were among the clinical signs of toxicity. No clinical signs of toxicity were observed in rats treated dermally with 2500 mg/kg. No clinical signs

of toxicity were noted among weanling male rats fed 125 or 1000 ppm QCB for 100 days, or in weanling females fed 125, 250, 500 or 1000 ppm QCB for 180 days. Adipose tissues did accumulate QCB at 1.5 to 2.2 times the dietary concentrations. WBC count was increased in groups fed 1000 ppm and red blood cell indices were decreased. Fertility and fecundity were not affected. Offspring of mothers fed ⩾ 250 ppm QCB developed tremors. Offspring of mothers who received 1000 ppm died before weaning. Some increases in weights of various body organs were also noted.

81-1729. Koschier, F. J.; Gigliotti, P. J.; Hong, S. K. (Sch. Med., State Univ. New York, Buffalo, NY 14214) **The effect of bis(*p*-chlorophenyl) acetic acid on the renal function of the rat.** *J. Environ. Pathol. Toxicol.* 4(5-6): 209-217; 1980 (12 references).

The effect of DDA, the principle water-soluble metabolite of DDT, on the *in vivo* renal function of the rat was investigated. Male Sprague-Dawley rats were infused iv with 100 mg/kg DDA. A significant decrease of ≈ 20% in the glomerular filtration rate was observed at 110 min after the start of the infusion. The mean arterial blood pressure, urine flow rate, renal clearance of tetraethylammonium and fractional reabsorption of sodium were unchanged throughout the experiment. During a 90 min infusion of 200 mg/kg DDA, a 60% decrease occurred in the glomerular filtration rate, renal clearance of tetraethylammonium, and the urine flow rate. The renal function decrease was accompanied by a drop from 125 to 60 mm Hg in mean arterial blood pressure. In isolated kidney experiments it was determined that DDT produced renal failure *in vivo*, which was associated with a reduction in renal perfusion pressure. It was concluded that the DDA could have caused a direct effect on nephron function.

81-1730. Gaylot, D. W.; Kodell, R. L. (Div. Biom., Natl. Cent. Toxicol. Res., Jefferson, AR 72079) **Linear interpolation algorithm for low dose risk assessment of toxic substances.** *J. Environ. Pathol. Toxicol.* 4(5-6): 305-312; 1980 (15 references).

Problems involved in the extrapolation of high-dose animal toxicity tests to low-level human exposure are considered. A modification to an earlier proposal is suggested. The earlier proposal recommended that any parametric model could be used which fits the data, extrapolation could be done to some moderate percentage risk, and then extrapolation could be performed from the confidence limit on that point to lower dosages using an arbitrary conservative value for the slope. The modification suggested is that extrapolation should not be outside the experimental data range of the parametric model used to describe the results in the experimental dose range. An arbitrary conservative slope is not used to extrapolate to lower doses, but rather a linear interpolation is used to obtain an upper bound on the risk at lower dosages. A justification for this modification is presented. A simple, widely applicable mathematical algorithm for performing low dose risk assessment from dose response data is discussed. The linear interpolation method described was applied to dose response data for 14 substances, including ethylenethiourea, TCDD, hexachlorobenzene, dieldrin and DDT. It was found that the low dose confidence limits resulting from the linear interpolation method were similar to those obtained from the Armitage-Doll multistage model.

81-1731. Ivanova-Chemishanska, L.; Vergieva, T.; Antonov, G.; Mirkova, E. (Inst. Hyg. & Occup. Health, Med. Acad., Sofia, Bulgaria) **Study on the long-term effects of some pesticides.** *J. Hyg. Epidemiol. Microbiol. Immunol.* 24(3): 295-302; 1980 (14 references).

A description is presented of several studies on the long-term effects of pesticides. The pesticides studies were fundasol (benomyl), endodan and basfungin (methyl metiram). Fundasol was found to affect male gonads (reduced wt and fertility), to decrease resistance and increase mortality in the F_1 generation, and to cause embryotoxicity, teratogenicity and cardiovascular effects in rats and mice. Endodan caused changes in the enzymatic activity in testes homogenates, and caused embryotoxicity in rats and mice at levels toxic to the mother. Basfungin showed teratogenic and embryotoxic effects, including metabolic disturbances in the fetal liver.

81-1732. Retnakaran, A.; Granett, J.; Robertson, J. (For. Pest Manage. Inst., Canadian For. Serv., Sault Ste. Marie, Ontario P6A 5M7, Canada) **Possible physiological mechanisms for the differential susceptibility of two forest Lepidoptera to diflubenzuron.** *J. Insect Physiol.* 26: 385-390; 1980 (28 references).

Studies were conducted to determine the nature of the high susceptibility of the tent caterpillar and the insensitivity of the spruce budworm to diflubenzuron. Both Lepidopterans were reared in the laboratory. Chitin synthesis rates were determined in controls and test organisms fed 0.5 μCi of ^{14}C-diflubenzuron. Retention of the radioactive material was also determined. The results indicated that the spruce budworm contained less chitin and retained less of the ingested diflubenzuron than the tent caterpillar. It is concluded that the higher sensitivity of the tent caterpillar is primarily due to the fact that more chitin synthesis inhibitor is retained, and secondarily because the total chitin content is lower.

81-1733. Matin, M. A.; Jaffery, F. N.; Siddiqui, R. A. (Ind. Toxicol. Res. Cent., Lucknow, U.P., India) **A possible neurochemical basis of the central stimulatory effects**

of *p,p'*-DDT. *J. Neurochem.* 36(3): 1000-1005; 1981 (42 references).

The stimulatory effects of *p,p'*-DDT on the nervous systems of mice were studied. Mice were administered the pesticide in doses of 200, 400 and 600 mg/kg. Some of the animals received barbituates to determine the effects of the combinations with DDT. Animals were observed for convulsions. After sacrifice, brains were removed and analyzed. Free ammonia was observed to increase, GABA decreased, and acetylcholine decreased in the brain. After 5 hr these changes were maximal and convulsions occurred. Barbituates reduced the severity of the convulsions. It is suggested that the stimulatory effect of DDT is a result of its action on ammonia levels, which may in return reduce the GABA level. Changes in acetylcholine are probably due to the DDT-induced convulsions.

81-1734. Lowy, R.; Griffaton, G.; Dupuy, F.; Ardouin, B.; Manchon, P. (Laboratoire Biol., Conservatoire Natl. Arts & Metiers, Paris, France) **Dietary no-effect level of a dithiocarbamate fungicide, thiram, evaluated from measurement data on rats. I. Choice of the model of the dose-response relationship.** *J. Toxicol. Environ. Health* 6(2): 403-419; 1980 (37 references).

Studies were performed to determine safe doses of thiram in rats. The animals were fed a well-balanced diet containing 0, 225, 300, 450, 600, 900 or 1200 ppm thiram/kg. At day 30 the rats were sacrificed and the wt of liver, kidney, heart, epididymal and perirenal fat, seminal vesicles, tibia, adrenals and thyroid were determined. Liver lactate, pyruvate, β-hydroxybutyrate, acetoacetate, ADP and ATP were estimated. Thiram dosages and values for the parameters measured (compared to controls) were correlated. Safe dose ($P = 0.95$, 0.99 and 0.999) which should have no effect on each variable studied were calculated. Three different models were used. A log-probit model was chosen for further studies. Weight of fat was the most sensitive parameter. Therefore, overall no effect dose based on fat wt was calculated. The suggested dose was 38 ppm.

81-1735. Chu, I.; Villeneuve, D. C.; Becking, G. C.; Iverson, F.; Ritter, L.; Valli, V. E.; Reynolds, L. M. (Environ. Health Cent., Ottawa, Ontario K1A 0L2, Canada) **Short-term study of the combined effects of mirex, photomirex, and Kepone with halogenated biphenyls in rats.** *J. Toxicol. Environ. Health* 6(2): 421-432; 1980 (16 references).

The combined effects of the pesticides mirex, photomirex and Kepone (chlordecone), and polychlorinated or polybrominated biphenyls (PCBs and PBBs), on rats was investigated. Groups of animals were dosed with the pesticides alone or in combination with a halogenated biphenyl. After 25 days of observation, the animals were anesthetized and exsanguinated via the abdominal aorta. Gross pathological observations were made and various tissues were examined histologically. Aroclor 1260 (PCB) + photomirex and all groups receiving PBB showed increased liver wt. Halogenated biphenyls alone caused hepatic enzyme activities to increase. Serum and hematology tests showed no effects. However, the livers of rats treated in any combination showed central lobular cytoplasmic enlargement, exaggerated periportal perinuclear holes, and anisokaryosis. The thyroids showed reduced follicular size. Kidneys showed mild eosinophilic cytoplasmic inclusions in the proximal convoluted tubule and focal lymphoid aggregates. Histological changes induced by PCBs and PBB were aggravated by the pesticides; however, the toxic effects were found to be additive. It was concluded that mirex-related compounds did not potentiate the effects produced by halogenated biphenyls, nor did the halogenated biphenyls potentiate the effects caused by the mirex compounds.

81-1736. Brimfield, A. A.; Street, J. C. (Interdep. Program Toxicol., Utah State Univ., Logan, UT) **Microsomal activation of chlordane isomers to derivatives that irreversibly interact with cellular macromolecules.** *J. Toxicol. Environ. Health* 7(2): 193-206; 1981 (32 references).

Studies using cofactor-fortified microsomes isolated from male C57BL/6J mice were designed to elucidate aspects of the binding of chlordane to endogenous protein, RNA and added DNA. ^{14}C-Labeled *cis* and *trans* isomers of chlordane were incubated with the microsome preparation for 30 min. RNA, DNA and protein were then separated from the microsomes and analyzed for radioactivity. The highest concentrations of radioactive material were found to be bound to protein, followed by RNA, then DNA. The *cis* isomer produced greater amounts of bound radioactivity. Microsomes induced by chlordane or phenobarbitol tended to increase binding to protein and DNA, but had no effect on binding to RNA. The inducers caused increased mixed-function oxidase activity, cytochrome P-450 content, and epoxide hydratase activity in experimental microsomes.

81-1737. Reuber, M. D. (Exp. Pathol. Lab., Frederick Cancer Res. Cent., NCI, Frederick, MD) **Carcinogenicity of picloram.** *J. Toxicol. Environ. Health* 7(2): 207-222; 1981 (13 references).

A review of studies on the carcinogenicity of picloram is presented. National Cancer Institute (NCI) studies involved feeding rats 10,000 or 20,000 ppm picloram for 39 wk and 5000 or 10,000 picloram for 41 wk. Low dose male rats showed an 84% increase in total neoplasms. High dose treated rats showed an 81% increase. Female rats showed an 80% and 96% increase in total neoplasms for low and high doses, respectively. Neoplasms increased at all sites tested. Malignant neoplasms included carcinomas and sarcomas. A second NCI study, using mice, indicated picloram-induced

neoplasms of the spleen in animals fed 5000 or 10,000 ppm picloram for 1 wk and 2500 or 5000 ppm for 79 wk. Picloram was also suggested to be responsible for atrophied testes. Several other tests, performed by Dow Chemical Co., indicated pathological changes occurred in rats but not in dogs, as a result of picloram ingestion.

81-1738. Roslavtseva, S. A. (All-Union Res. Inst. Plant Prot., Leningrad, USSR) **Esteraznye mekhanizmy razistentnosti tlei k afitsidam. [Esterase mechanisms of resistance of aphids to aphicides.]** *Khim. Sel'sk. Khoz.* 19(1): 37-39; 1981 (30 references) (Russian).

Literature data on the esterase mechanisms of resistance to aphicides are reviewed. Electrophoretic fractionation of esterases showed that aphids with low activity of carboxylases were sensitive to organophosphorus and carbamate aphicides. An increase of carboxylesterase activity was associated with development of resistance.

81-1739. Furuya, K.; Urasawa, S. (Dep. Hyg., Sapporo Med. Coll., Sapporo, Japan) **Gas-liquid chromatographic demonstration of the specificity of rabbit IgG antibody to the pesticide DDT and its metabolites.** *Mol. Immunol.* 18(2): 95-102; 1981 (12 references).

A study was conducted to determine whether rabbit IgG antibody specificity to DDT would be altered by minor differences in the structure of DDT. The antibody specificity was demonstrated by studying primary binding interactions between the antibody and DDT and each of its metabolites, and also by studying competitive binding interactions between the antibody and DDT in the presence of each metabolite, *o,p'*-DDT, or their mixtures. Bound hapten molecules were separated from unbound free hapten molecules by precipitation with 50% saturation of ammonium sulfate after establishing equilibrium between antibody and hapten. The amount of unbound free hapten molecules remaining in the supernatant was then determined by ECD gas-liquid chromatography. The study demonstrated that gas chromatography appears useful for the analysis of specificity of hapten-antibody reactions, especially binding reactions between antibody and hydrophobic haptens, for which radioiostope-labeling is difficult. It was concluded that rabbit IgG antibody to DDT discriminates minor differences in structure among DDT and the haptens with regard to the position and number of chlorine atoms and to the aliphatic carbon structure.

81-1740. Jones, A. R.; Porter, K.; Stevenson, D. (Biochem. Dep., Univ. Sydney, Sydney, New South Wales 2006, Australia) **The renal toxicity of some halogenated derivatives of propane in the rat.** *Naturwissenschaften* 68(2): 98-99; 1981 (12 references).

Among the halogenated derivatives of propane are the rodenticide *α*-chlorohydrin and the nematocide 1,2-dibromo-3-chloropropane (DBCP). Exposure to these compounds causes prolonged diuresis in rats, accompanied by increased glucose excretion. Incubation of rat kidney tubule with either D(U-^{14}C)glucose (1 m*M*) or L(U-^{14}C)lactate (2 m*M*) with the intermediates sodium 3-chlorolactate or sodium 3-bromolactate inhibited glucose and lactate oxidation. The mechanisms of inhibition appear to be inhibition of glycolysis by the 3-haloacetates produced by partial oxidation *in vivo* and by the formation of oxalate derived from their complete oxidation *in vivo*. Caution against the misuse of such chemicals is urged since continuous exposure could lead to kidney damage.

81-1741. Yamamoto, Y.; Noma, T.; Noma, Y.; Kamino, K.; Takimoto, Y. (Res. Lab., Senju Pharm. Co. Ltd., Itami, Hyogo, Japan) **[Effect of *N*-acetyl-L-cysteine on the ocular lesion caused by an agricultural fungicide, Blasticidin S.]** *Nippon Ganka Kiyo (J. Jpn. Ophthalmol.)* 31(9): 1481-1488; 1980 (8 references) (Japanese).

An aqueous emulsion containing 0.15% of the fungicide Blasticidin S was applied to both eyes of 4 groups of 5 white rabbits. *N*-Acetyl-L-cysteine (AC), 1, 3, 5 or 10% aqueous solutions at pH 7.3, was then applied to the right eyes of the respective groups. Sodium chloride, 0.4, 1.1, 1.9 and 4.2% aqueous solutions respectively isotonic to each AC solution, were applied to the left eyes of the respective groups as a control. Application rates were 0.1 ml/eye 5 times/day for 2 wk. The Blasticidin S emulsion was applied at 20 μl/eye. Inflammation due to Blasticidin S appeared to be most severe on days 3 and 4 after application. Inflammation disappeared from almost all eyes on day 14 when treated with the 3, 5 or 10% AC solutions. Neither corneal opacity, corneal epithelial erosion, conjuctival congestion or edema was observed in rabbits treated with the 3, 5 or 10% solutions. In the group treated with 1% AC and in the control group, corneal opacity, epithelial erosion and vascularization were observed in all cases.

81-1742. Danilewicz, M.; Kurnatowski, A.; Wagrowska-Danilewicz, M. (Pathol. Inst., Dep. Pathol. Anat., Med. Acad., PL-90141 Lodz, Poland) **Dynamika zmian patomorfologicznych w niektorych wewnetrznych narzadach szczurow zatrutych smiertelnymi dawkami siarczanu talawego i leczonych dithiocarbem, ze szczegolnym uwzglednieniem zmian w nerkach. [Dynamics of pathomorphological changes in some internal organs of rats poisoned with lethal doses of thallous sulfate and treated with dithiocarb, with special attention to renal changes.]** *Patol. Pol.* 31(4): 559-565; 1980 (16 references) (Polish).

Experiments were carried out on 40 male Wistar rats poisoned with thallous sulfate and then immediately

given dithiocarb ig. Pathomorphological changes, particularly in the excretory organs, were monitored to determine the antagonistic effects of dithiocarb on thallous sulfate. Kidney sections of poisoned rats were analyzed by light and electron microscopy and liver and brain tissues were examined by light microscopy. Blood urea concentrations and the presence of protein in the urine were determined. The results indicate that dithiocarb did not exhibit a protective effect on the animals. All treated rats died by day 4 after poisoning. Pathomorphological changes in the kidneys, brains and livers did not differ between animals given dithiocarb and those that received thallous sulfate alone.

81-1743. Belasco, I. J.; Baude, F. J. (Biochem. Dep., Res. Div., Exp. Stn., E. I. du Pont de Nemours & Co. Inc., Wilmington, DE 19898) **The metabolism of (^{14}C)cymoxanil in the rat.** *Pestic. Sci.* 12(1): 27-36; 1981 (4 references).

A rat, given a single oral dose of [^{14}C]cymoxanil, 1-(2-cyano-2-methoxyimino- 2-^{14}C]-acetyl) -3-ethylurea (DPX-3217), eliminated 91% of the radioactivity within 72 hr. The urine contained 71%, the feces 11%, and the expired air about 7% of the radiolabel; no ^{14}C residue was found in the internal organs. Greater than 70% of the radioactivity in the urine was identified. The major metabolite was characterized as glycine, both free and conjugated, as hippuric acid and as phenylaceturic acid [*N*-(phenylacetyl) -glycine], and probably in the form of polypeptides of low molecular wt. The other metabolites identified included 2-cyano-2-methoxyiminoacetic acid, 2-cyano-2-hydroxyiminoacetic acid and 1-ethylimidazolidine- 2,4,5-trione. The minor metabolites included succinic acid and 2-oxyglutaric acid which indicated reincorporation of metabolic ^{14}C. Cymoxanil, as such, was not detected in the urine. (Author abstract by permission)

81-1744. Mitchell, S. C.; Waring, R. H. (Dep. Biochem., Univ. Birmingham, Birmingham B15 2TT, England) **The metabolism of benodanil in the rat.** *Pestic. Sci.* 12(1): 79-85; 1981 (17 references).

The metabolism of benodanil (2-iodobenzanilide) was studied in rats following an oral dose of 150 mg benodanil/kg body wt. The major 24 hr urinary metabolite was found to be the 4′-hydroxy derivative, both free (≈ 5%) and as the glucuronide (≈ 4%) and sulfate (≈ 4%) conjugates. Over a 6-day period, about 16% of the administered dose was excreted in the urine and about 80% in the feces. After dosing with [^{14}C]benodanil, blood radioactivity levels were highest 30 min after dosing, with small broader peaks at 4 and 7 hr, while biliary activity levels rose slowly to a maximum about 10-12 hr after the dose, some 16% being excreted in 24 hr as the glucuronide conjugate of the 4′-hydroxy derivative. (Author abstract by permission)

81-1745. Smith, T. F.; Noack, A. J.; Cosh, S. M. (Muresk Agric. Coll., Northam, Western Australia, Australia) **The effect of some herbicides on vesicular-arbuscular endophyte abundance in the soil and on infection of host roots.** *Pestic. Sci.* 12(1): 91-97; 1981 (12 references).

The effect of the herbicides di-allate, diquat, diuron, paraquat, triallate and trifluralin, at a range of application rates from 0.5 to 32 times that recommended by the manufacturers, on vesicular-arbuscular (V-A) endophyte spore abundance in the soil and on infection of wheat roots was investigated in field and glasshouse experiments. Paraquat and diquat had no measurable effect on V-A endophyte spore abundance. There was a slight trend to lower V-A endophyte spore numbers at high rates of application of di-allate and triallate but no trend for the other chemicals. Infection intensity (% root length infected) declined at high rates of di-allate and led to lower mycorrhizal root wt. The phosphorus content of the shoots was also reduced by di-allate. High doses of di-allate, diuron, triallate and trifluralin reduced most parameters of plant growth more than mycorrhizal parameters. It is therefore concluded that at normal application rates these chemicals are unlikely to affect adversely endomycorrhiza formation or function. (Author abstract by permission)

81-1746. Mundade, D. L.; Konde, B. K.; More, B. B. (Dep. Plant Pathol. & Agric. Microbiol., Mahatma Phule Krishi Vidyapeeth, Ahmednagar 413722, India) **Effect of different pesticides on growth of *Rhizobium* sp. on germination of groundnut seeds.** *Pesticides* 14(10): 24-28; 1980 (7 references).

Ten pesticides were tested for their effect on the growth of *Rhizobium* sp. (a nitrogen-fixing bacteria which increases legume yields) and on the germination of groundnut seeds. It is critical to determine whether pesticide treatment of seeds will kill or inhibit the nodule bacteria, thus nullifying their beneficial effect. The effects of pesticides on *Rhizobium* growth was determined by placing a filter paper disc impregnated with bacteria culture on a petri plate containing agar treated with pesticide. Growth of *Rhizobium* was assessed by the growth zone around the disc. It was noted that all of the pesticides inhibited growth to some extent, but the bacteria could grow reasonably well in the presence of all except Ceresan (ethylmercuric chloride) and thiram + carbofuran. In a second experiment, germination was evaluated in seeds treated with the pesticides either before or after inoculation with *Rhizobium*. Data indicate that all pesticides tested enhanced germination. Pesticide applications made after inoculation with *Rhizobium* were more effective. In this case, thiram, Brassicol (PCNB; quintozene), Blitox-50 (copper oxychloride), Vitavax (carboxin), thiram + carbofuran, Dithane-Z-78 (zineb), wet Ceresan and Aurofungin enhanced the germination from 85% to 114.14%. Carbofuran enhanced germination by 71.34% over control, and Benlate (benomyl) by 57% over control.

81-1747. Stedman, T. M., Jr.; Booth, N. H.; Bush, P. B.; Page, R. K.; Goetsch, D. D. (Coll. Vet. Med., Poult. Sci. Dep., Univ. Georgia, Athens, GA 30602) **Toxicity and bioaccumulation of pentachlorophenol in broiler chickens.** *Poult. Sci.* 59(5): 1018-1026; 1980 (42 references).

Hubbard-Hubbard broiler chickens were fed graded levels (0, 1, 10, 100 and 1000 ppm) of pentachlorophenol (PCP) containing < 0.0023% octachlorodibenzo-*p*-dioxin (OCDD) for 8 wk. Tissue samples for PCP, OCDD and pentachloroanisole (PCA) were cleaned up via gel permeation chromatography and analyzed by gas chromatography employing electron capture detection. Kidney weights were significantly increased by the 100 ppm and 1000 ppm PCP diet. Weights of all other organs including body wt were significantly lowered by the 1000 ppm PCP diet. Except for the control group, histopathologic examination of the liver revealed bile duct proliferation and some fatty changes in all of the 6-wk-old birds. Examination of the brain, liver, gizzard, pancreas, intestine, proventriculus, spleen, kidney, lung, and heart revealed no histopathological lesions in the treated or control birds. Significant linear relationships were found between PCP accumulation in tissues and the concentration of dietary PCP. Accumulation of PCP was greatest in the kidney followed by liver, heart, leg, breast, gizzard, and fat. The high residue levels in the kidney and liver may reflect principal routes of elimination and metabolism. Following a 5 wk withdrawal of PCP from the diet, PCP residues were still present in the adipose tissue of all treated birds. Residue levels in the kidney and liver were reduced at the 1st and 3rd wk of withdrawal, but a continuous decline was interrupted by a slight elevation in residue level at the 5th wk of withdrawal from the chemical. (Author abstract by permission)

81-1748. Johnston, C. E.; Cheverie, J. C. (Dep. Biology, Univ. Prince Edward Island, Charlottetown, Prince Edward Island C1A 4P3, Canada) **Repopulation of a coastal stream by brook trout and rainbow trout after endosulfan poisoning.** *Prog. Fish Cult.* 42(2): 107-110; 1980 (9 references).

Trout populations in the Dunk River before and after an accidental spill of the insecticide endosulfan are reported. The chemical was discharged into North Brook, a small tributary of Dunk River, on August 28, 1975. Brook and rainbow trout populations were sampled in March 1973, October 1974, July 1975, and June 1976, by electrofishing. Before the spill population estimates were 246-456 brook trout and 5-27 rainbow trout/100 m of stream. From late September through November of 1975 brook trout were visually observed to be present in small numbers in North Brook. In June 1976, electrofishing was resumed for data collection. At this time the study site was repopulated primarily by age I and age II trout, 7.3-16.0 cm long. All age classes indicated populations of 135 brook trout and 10 rainbow trout/100 m of stream. It was concluded that trout populations in this coastal stream are mobile and can quickly repopulate after a large kill.

81-1749. Brigelius, R.; Anwer, M. S. (Inst. Physiol. Chem. I, Univ. Dusseldorf, D-4000 Dusseldorf, BRD) **Increased biliary GSSG-secretion and loss of hepatic glutathione in isolated perfused rat liver after paraquat treatment.** *Res. Commun. Chem. Pathol. Pharmacol.* 31(3): 493-502; 1981 (18 references).

To analyze selected physiological responses of rat livers to paraquat (PQ) exposure, liver of 3-mo-old rats were perfused in a hemoglobin-free non-circulating system. After 20 min of initial perfusion treatment, livers were exposed to 1 mmol PQ/ℓ for 160 min. Glutathione release into the vena cava perfusate and bile was increased. Increases into the perfusate were only 19.2%; however, increases into the bile were 245%. Subsequently, liver glutathione levels decreased significantly (from 2.74 to 0.08 μmol/g liver). The ratio of GSSG to GSH + 2GSSG increased significantly, apparently because GSSG in the liver was not altered by PQ. It appears that the radical scavanging properties of GSH allow it to react with radicals produced by PQ. The resultant reactions may lead to functional alterations of cellular membrane proteins and loss of hepatic GSH.

81-1750. Aldridge, W. N. (Toxicol. Unit., Med. Res. Counc., Carshalton, England) **Organophosphorous compounds: molecular basis for their biological properties.** *Sci. Progr. (London)* 67(265): 131-147; 1981 (33 references).

The molecular basis of the biological properties of organophosphorus compounds is reviewed. Discussion of acute toxicity in this paper is limited to those compounds that induce phosphylate esterases. Thionophosphates (malathion, parathion and EPN) are used as examples; they inhibit AChE. Many are inert until converted to the corresponding oxons. The mechanisms of action generally involve serine in the catalytic mechanism. The esterases can be reactivated with nucleophiles, such as atropine, to reverse the inhibition of AChE. Chronic toxicity by certain organophosphorus compounds leads to delayed neuropathy. There is evidence that proteins are phosphorylated then hydrolyzed in the onset of chronic toxicity. The value of early stoichiometric research in the development of current knowledge of the mechanisms of molecular chemistry is discussed.

81-1751. Neligan, P.; Stewart, J. C. M. (Dep. Med., Univ. Dundee, Dundee, Scotland) **Ethacrynic acid: effective treatment for paraquat lung.** *Scott. Med. J.* 26(1): 92; 1981.

A case report of a 45-yr-old man, who attempted suicide through ingestion of paraquat, is summarized. The patient survived after ethacrynic acid therapy. In both animal and plant tissues, the toxic action of paraquat is mediated through generation of superoxide radicals. It was postulated that ethacrynic acid would scavenge the superoxide ions since is a π-electron acceptor. The patient's

lung function has continued to improve over the last 6 mo. Ethacrynic acid has also been shown to protect bean plants against the effects of paraquat. [Presented at the 1980 annual meeting of the Scottish Society of Physicians.]

81-1752. Lauterburg, B. H.; Smith, C. V.; Mitchell, J. R. (Dep. Med., Baylor Coll. Med., Houston, TX 77030) **Molecular mechanisms involved in drug-induced pulmonary injuries.** *Semin. Respir. Med.* 2(2): 45-50; 1980 (28 references).

The mechanisms of various types of pulmonary injuries are reviewed. The toxicologies of oxygen, paraquat, nitrofurantoin, and alkylating drug intermediates are included. The main site of paraquat toxicity is the lung, characterized by edema and interstitial pneumonitis. The toxicity can be potentiated by increased atmospheric O_2 concentrations. The herbicide molecule is reduced by NADPH, which produces a superoxide anion radical. The subsequent toxicity is related to the reactive O_2 species, and is similar to oxygen toxicity. The role of the immune system in drug toxicity is discussed; however, no relationship has been observed between paraquat poisoning and the immune system.

81-1753. Mikuriya, H.; Hayashida, S.; Takahashi, H.; Hiraga, K. (Tokyo Metrop. Res. Lab. Public Health, Tokyo, Japan) **[Acute oral toxicity test of thiabendazole in rats.]** *Tokyo Toritsu Eisei Kenkyusho Kenkyo Nempo (Annu. Rep. Tokyo Metrop. Res. Lab. Public Health)* 31(2): 20-25; 1980 (5 references) (Japanese).

The acute oral toxicity of thiabendazole was examined by forced administration in olive oil and aqueous 0.5% gum arabic solution to male and female Fischer rats. Treatment groups contained 5 animals each. Symptoms in both sexes included closed eyes, lacrimation, reduction of spontaneous movement and tremor of extremities. The LD50 for administration in olive oil was 1075 mg/kg in males and 1180 mg/kg in females. Administration in gum arabic solution gave a male LD50 of 1325 mg/kg and a female LD50 of 1750 mg/kg. No significant difference between dispersion agent or sex was found. However, an inversion of the dose-mortality in females administered thiabendazole in aqueous gum arabic solution was noted. Treatment was repeated by the administration of one level to 5, 10 and 15 animals, respectively. The results of the repeated experiments supported the original data. The slope function and LD50 values were approximately 1.45 and 1200 mg/kg, respectively.

81-1754. Fujita, H.; Hiraga, K. (Tokyo Metrop. Res. Lab. Public Health, Tokyo, Japan) **[Effect of butylated hydroxytoluene on the mutagenicity of thiabendazole in the *Salmonella*/microsome test.]** *Tokyo Toritsu Eisei Kenkyusho Kenkyo Nempo (Annu. Rep. Tokyo Metrop. Res. Lab. Public Health)* 31(2): 26-28; 1980 (13 references) (Japanese).

The Ames test was performed on mixtures containing thiabendazole at 100, 500 and 1000 μg/0.05 ml DMSO and 1, 5, 10, 50 and 100 μg/0.05 ml butylated hydroxytoluene. When microsomal homogenates of phenobarbital-induced, male Wistar rat were used for activation the number of revertant colonies increased 3-fold at concentrations of 1000 μg thiabendazole and 30 μg butylated hydroxytoluene. It was calculated that thiabendazole produced 0.018 revertant colonies/μmol. Butylated hydroxytoluene was assumed to act as a co-mutagen to thiabendazole.

81-1755. Fujita, H.; Hiraga, K. (Tokyo Metrop. Res. Lab. Public Health, Tokyo, Japan) **[Mutagenicity of paired fungicide mixtures in the *Salmonella*/microsome test.]** *Tokyo Toritsu Eisei Kenkyusho Kenkyo Nempo (Annu. Rep. Tokyo Metrop. Res. Lab. Public Health)* 31(2): 29-32; 1980 (17 references) (Japanese).

The mutagenicity of 6 paired combinations of the fungicides thiabendazole, *o*-phenylphenol, biphenyl and butyl *p*-hydroxybenzoate in solution in DMSO was evaluated using the Ames test. Concentrations of 1, 10, 100 and 1000 μg fungicide/plate were used. Homogenate of male Wistar rat liver, induced by phenobarbital, was applied at 150 μl/plate. A mixture of 1000 μg thiabendazole and 30 μg *o*-phenylphenol showed a 3-fold increase in revertant colonies, corresponding to 0.014 revertants/μmol thiabendazole. *o*-Phenylphenol was concluded to be a weak comutagen.

81-1756. Sasaki, M.; Nakao, J.; Hiraga, K. (Tokyo Metrop. Res. Lab. Public Health, Tokyo, Japan) **[Carcinogen bioassay in mice. Preliminary experiments on transplacental and neonatal treatments of test substance, thiabendazole.]** *Tokyo Toritsu Eisei Kenkyusho Kenkyo Nempo (Annu. Rep. Tokyo Metrop. Res. Lab. Public Health)* 31(2): 127-130; 1980 (4 references) (Japanese).

Thiabendazole was administered to mice at 25 and 12.5 mg/0.1 ml olive oil/mouse, 3 times on pregnancy days 16, 17 and 18. On pregnancy day 16, 50 mg/0.1 ml olive oil/mouse was administered. No death or abortus resulted. Examination of neonates revealed dermatitis and vesical stones in males, and hypertrophy of thymus and leukemia in females. However, comparative examination of the central group (olive oil only) had not been completed. Neonates from untreated pregnant ICR mice were treated with DMSO diluted solutions of thiabendazole. Animals were injected with 0.01 ml/animal within 24 hr of birth. Mortality was low, and the rats are currently under observation.

81-1757. McConnell, E. E.; Moore, J. A.; Gupta, B. N.; Rakes, A. H.; Luster, M. I.; Goldstein, J. A.; Haseman, J. K.; Parker, C. E. (Environ. Biol. Branch, NIEHS, Research Triangle Park, NC 27709) **The chronic toxicity of technical and analytical pentachlorophenol in cattle. I. Clinicopathology.** *Toxicol. Appl. Pharmacol.* 52(3): 468-490; 1980 (59 references).

The objectives of this study in female yearling Holstein cattle were to define the toxic effects of long-term exposure to analytical pentachlorophenol (aPCP), and to determine the influence of the contaminants in technical pentachlorophenol (tPCP) in the toxic syndrome. Four groups of 3 heifers each were exposed for 160 days to aPCP, tPCP, or a mixture thereof in the feed. A fifth group of 3 animals served as unexposed controls. All treated cattle received the same amount of PCP; 20 mg/kg/day for 42 days which was reduced to 15 mg/kg/day for the remainder of the study because of a suspected decrease in body wt gain in all PCP-exposed animals compared to controls. Fat and liver samples for chemical analyses were collected at the end of the study. Major findings in the tPCP-exposed heifers included a dose-related decrease in body wt, decreased feed efficiency, progressive anemia, a dose-related increase in liver and lung wt, and a decrease in thymus wt. The most conspicuous lesion was marked villous hyperplasia of the urinary bladder mucosa in 2 of 3 animals exposed to the highest level of tPCP. There were minimal hepatic lesions although hyperplasia of the mucosal lining of the gall bladder and bile duct was noted in some animals exposed to tPCP. Animals exposed to aPCP were, in general, comparable to the controls. Hepatic mixed function oxidases were increased by aPCP, but more so by tPCP. A decrease in thyroxine concentration was found in all PCP-treated cattle. Immunologic studies suggested a progressive tPCP dose-related enhancement in the lymphoproliferative response, an *in vitro* correlate for cell-mediated immunity. Observed effects on humoral immune parameters were equivocal. The results of this study indicate that toxicity of PCP in cattle is primarily attributable to its contamination with toxic impurities. (Author abstract by permission)

81-1758. Carlson, G. P.; Schoening, G. P. (Dep. Pharmacol. & Toxicol., Sch. Pharm. & Pharm. Sci., Purdue Univ., West Lafayette, IN 47907) **Induction of liver microsomal NADPH cytochrome *c* reductase and cytochrome *P*-450 by some new synthetic pyrethroids.** *Toxicol. Appl. Pharmacol.* 52(3): 507-512; 1980 (18 references).

Newly developed synthetic pyrethroids were evaluated for their ability to alter microsomal cytochrome P-450 and NADPH cytochrome *c* reductase in rats. Permethrin (80:20, *cis:trans*), 50 mg/kg/day po, increased cytochrome P-450 after 4, 8, or 12 days of administration and NADPH cytochrome *c* reductase after 8 or 12 days. A mixture containing less of the *cis* form (40:60, *cis:trans*) did not alter either cytochrome P-450 or NADPH cytochrome *c* reductase after 4 days of administration but increased both after 8 or 12 days. α-Cyano analogs of permethrin (40:60, *cis:trans* and 97:3, *cis:trans*) did not induce either cytochrome P-450 or NADPH cytochrome *c* reductase. None of the preparations altered body wt gain. Permethrin, but not its α-cyano analog, appears to be a weak inducer of the mixed function oxidase system. (Author abstract by permission)

81-1759. Truhaut, R.; Anger, J. P.; Anger, F.; Brault, A.; Brunet, P.; Cano, Y.; Louvet, M.; Saccavini, J. C.; van den Driessche, J. (Lab. Toxicol. & Hyg. Ind., U.E.R. Mec. Action Med. & Toxiques, Univ. Rene Descartes, F-75006 Paris, France) **Degradation thermique de l'oxyde de tributyletain (OTBE) et toxicite pulmonaire des produits de combustion chez la souris et le cobaye. [Toxic effects induced by inhalation of thermolysis products from bis(tributyltin) oxide (TBTO) in mouse and guinea pig.]** *Toxicol. Eur. Res.* 3(1): 35-44; 1981 (6 references) (French).

The effects of inhalation of bis(tributyltin) oxide (TBTO) thermolysis products were studied. Thermolysis was conducted at 200 and 600°C. Mice and guinea pigs were subjected to the thermolysis products, which included saturated hydrocarbon and olefin gas, a condensate of tetrabutyltin and dibutyltin oxide, and a residue of stannous or stannic oxides. Pulmonary toxicity was greater at low temperatures. After heating the toxic effects decreased. Localization and histopathologic studies confirmed these results. The products of 600°C thermolysis caused no deaths; some behavioral problems were produced. It is suggested that the effects of repeated exposures might include a delayed toxicity.

81-1760. Rao, T. N.; Sanyal, S.; Agarwal, N.; Subrahmanyam, D. (Dep. Biochem., Postgrad. Inst. Med. Educ. & Res., Chandigarh 160012, India) **Effect of a single oral dose of DDT on lipid metabolism in rat.** *Toxicol. Lett.* 7(3): 263-266; 1981 (9 references).

The effect of DDT on the lipid levels of adipose tissue, liver and plasma and on the lipoprotein lipase activity of these tissues was investigated. A single dose of purified and recrystallized DDT was given to male Wistar rats at 600 mg/kg. After 5 hr, the animals were sacrificed under light ether anesthesia. In separate experiments, rats were given heparin ip at 500 IU/rat, 4.5 hr after DDT administration. No changes were noted in the lipid fractions of adipose tissue and plasma in DDT-exposed animals. Plasma triglyceride levels showed a decreasing trend, but not a statistically significant one. A significant fall was noted in the activity of lipoprotein lipase in post-heparin plasma, whereas the enzyme activities in liver and adipose tissue were not changed. An increase in plasma triglyceride was expected but none occurred. Liver phospholipid and triglyceride levels decreased significantly in DDT-fed rats.

It was concluded that adipose tissue lipid metabolism in albino rats was not affected by a single lethal oral dose of DDT. Liver metabolism seemed to be altered, probably due to changes in other tissues, such as the CNS.

81-1761. Lambotte-Vandepaer, M.; Duverger-Van Bogaert, M.; de Meester, C.; Rollmann, B.; Poncelet, F.*; Mercier, M. (Lab. Biotoxicol., Sch. Pharm., Univ. Louvain, B-1200 Brussels, Belgium) **Identification of two urinary metabolites of rats treated with acrylonitrile; influence of several inhibitors on the mutagenicity of those urines.** *Toxicol. Lett.* 7(4-5): 321-327; 1981 (17 references).

The effects of several pretreatments on the mutagenicity of urines collected from rats treated with acrylonitrile (ACN; a tobacco fumigant) are described. Two additional urinary metabolites are also identified which are likely derived from an intermediate epoxide. Adult male Wistar rats were fed a single ip dose of 30 mg/kg ACN in saline solution. Pretreatment was given with: $CoCl_2$, 2 sc injections of 60 mg/kg 48 and 24 hr before ACN; SKF 525-A, 40 mg/kg ip 1 hr before ACN; pyrazole, 320 mg/kg ip 48 hr before ACN treatment, and trichloroacetonitrile (TCA), 1 mg/kg ip together with ACN. Pretreatment with $CoCl_2$ and SKF 525-A almost completely abolished the mutagenic activity of the urine collected after the animals had been injected with ACN. A similar decrease was noted when ACN was administered with TCA, which acts as a radical trapping agent. A less pronounced, but still significant, effect was noted when rats were pretreated with pyrazole, a known inhibitor of the alcohol dehydrogenase. Cyanoethanol and cyanoacetic acid, 2 urinary metabolites, were detected by gas chromatography.

81-1762. Leonard, A.; Garny, V.; Poncelet, F.; Mercier, M. (Mammal. Genet. Lab., Dep. Radiobiol., CEN-SCK, B-2400 Mol, Belgium) **Mutagenicity of acrylonitrile in mouse.** *Toxicol. Lett.* 7(4-5): 329-334; 1981 (15 references).

The clastogenic properties of acrylonitrile (ACN) were studied using somatic and germ cells of male NMRI mice. The mice were given ip injections of 20 or 30 mg/kg ACN. Action on bone marrow cells was followed at 6, 18, 24, 48 and 72 hr after injection. The ability of ACN to produce chromosome aberrations in male meiotic and post-meiotic male germ cells was tested with the dominant lethal assay. It was found that an ip injection of isopropyl methane sulfonate (IMS) significantly increased the yield of micronuclei in erythrocytes and of chromosome aberrations in bone marrow cells. IMS was also highly effective in producing dominant lethals and caused sterility of the mice due to cell death, as shown by a decrease in testicular wt 4 wk after injection. All tests performed with ACN on somatic cells or in germ cells yielded negative results. These findings confirm that ACN has no clastogenic properties in male mouse cells *in vivo*.

81-1763. Appel, K. E.; Peter, H.; Bolt, M.; Bolt, H. M. (Abt. Toxikol., Pharmakol. Inst., Univ. Mainz, D-6500 Mainz, BRD) **Interaction of acrylonitrile with hepatic microsomes of rats and men.** *Toxicol. Lett.* 7(4-5): 335-339; 1981 (20 references).

Spectral interactions of acrylonitrile (ACN) with cytochrome P-450 of rat, mouse, and human liver microsomes were compared. ACN demonstrated spectral interaction with the monooxygenase system of hepatic microsomes from different species, including humans. Substrate binding spectra were obtained with microsomes from phenobarbital-pretreated mice only, not from mice pretreated with benzo(*a*)pyrene. Human and rat liver microsomes showed ligand spectra with ACN. Differential pretreatment of rats did not influence the spectral type of microsomal ACN interaction. However, qualitative differences were noted in different pretreatments. The findings of the study indicate that, in terms of microsomal ACN interaction, rats resemble humans much more closely than do mice.

81-1764. Gopal, K.; Khanna, R. N.; Anand, M.; Gupta, G. S. D. (Ind. Toxicol. Res. Cent., Mahatma Gandhi Marg, Lucknow 226001, India) **The acute toxicity of endosulfan to fresh-water organisms.** *Toxicol. Lett.* 7(6): 453-456; 1981 (9 references).

Fish, insect nymphs and frog tadpoles were used as test specimens to evaluate the acute toxicity of endosulfan. Endosulfan was applied at concentrations of 0.005-0.04 ppm to catfish and insect nymphs. Frog tadpoles were exposed to 0.001-0.004 ppm. Exposure was for 96 hr. Fish demonstrated jumping, erratic movement and convulsions. A rapid rate of opercular movement was accompanied by occasional gulping of air until equilibrium was lost, and death followed. Hyperglycemia was maximum at 48 hr at all concentrations, suggesting that endosulfan may interfere with carbohydrate metabolism. Similar symptoms were noted in the insect nymph and frog tadpoles, including severe reduction in free swimming and reduced physical stamina. Frog tadpoles appeared to be the most susceptible of the species examined.

81-1765. Srivastava, V.; Misra, R. C. (Dep. Biochem., Univ. Lucknow, Lucknow 226007, India) **Effect of endosulfan on plasma membrane function of the yeast *Rhodotorula gracilis*.** *Toxicol. Lett.* 7(6): 475-480; 1981 (15 references).

The interaction of endosulfan with the cell membrane of the yeast *Rhodotorula gracilis* is described. Cells were treated with endosulfan for 30 min under aerobic con-

ditions. At 10 ppm concentrations the rate of oxygen consumption was nearly the same as in control cells. At concentrations of 50, 100 and 200 ppm, oxygen consumption was 28-74% greater. Endosulfan appeared to decrease the efficiency of the proton pump and reduce the rates of D-xylose transport. The rate of respiration was simultaneously increased. It was considered likely that the interaction of endosulfan with membrane components caused, besides other changes, an uncoupling effect on the mechanism of energy coupling in D-xylose transport. At 50 ppm, the optimum temperature of the initial velocity of D-xylose transport did not change, but the rate of transport was sharply lowered. Further study indicated that the effects of endosulfan were concentration dependent and that endosulfan reacts with membrane components which are indirectly linked with D-xylose transport.

81-1766. Voronina, V. M.; Popov, T. A.; Kagan, Yu. S.; Pismennaya, M. V. (All-Union Res. Inst. Hyg. & Toxicol. Pestic. Polym. & Plast., Kiev, USSR) **Vliyanie oksidaz smeshannoi funktsii na prevrashchenie ftalofosa v pecheni krys. [Effect of the mixed function oxidases on phthalophos transformation in rat liver.]** *Ukr. Biokhim. Zh.* 53(1): 26-29; 1981 (13 references) (Russian).

The effect of induction and inhibition of liver hydroxylating enzymes on the rate of phthalophos (phosmet) degradation was studied in the perfused rat liver. Random-bred rats were subjected to a po daily administration of the organochlorine pesticide milbex at 0.2 LD50 (to induce the hydroxylating enzyme system) or the dithiocarbamate pesticide tetramethylthiuramdisulfide (TMTD, thiram) at 0.2 LD50 (to inhibit the hydroxylating enzyme system). Pesticides were given for 3 days. Two days after termination of pesticide administration, rats were sacrificed and the isolated perfused liver was exposed to phthalophos at 8 μg/ml of perfusate. It was found that the hydroxylating enzyme system had a significant effect on the rate of phthalophos degradation. Milbex enhanced phthalophos degradation, while TMTD delayed phthalophos degradation.

81-1767. Crowder, L. A. (Dep. Entomol., Arizona Univ., Tuscon, AZ) **Mode of action of cyclodiene insecticides: the nervous system influenced by toxaphene.** *US NTIS PB Rep.* PB80-186,042: 111 pp.; 1980 (55 references).

A study was made concerning the mode of action, excretion, metabolism, and behavioral effects of toxaphene and combinations of toxaphene, methyl parathion, and/or chlordimeform in various insects, the mouse and the rat. Toxaphene altered ionic movements within the central nervous system of the cockroach, *Periplaneta americana*; increased levels of cAMP and cGMP in tissues of the cockroach, *Leucophaea maderae*, and the mouse; and inhibited ATPase enzymes in tissues of *P. americana* and the mouse. Rat pups peri-natally exposed to sublethal doses of toxaphene and methyl parathion showed few significant changes in motor skills, behavior, or learning ability. Postnatal exposure to toxaphene did lead to an impairment of learning ability in adult rats as measured by a simple T-maze. Combining chlordimeform or methyl parathion with ^{36}Cl-labeled toxaphene produced some significant changes in the amount of ^{36}Cl recovered in feces and the amount deposited in tissues of orally-dosed mice. Combining toxaphene with methyl parathion did not potentiate the toxicity of methyl parathion under laboratory conditions to various hemipteran predators and lepidopterous pests. (Author abstract by permission)

81-1768. Kalmykova, T. P. (All-Union Inst. Exp. Vet. Sci., USSR) **Metody opredeleniya mutagennoi aktivnosti pestitsidov. [Methods of determination of the mutagenic activity of pesticides.]** *Veterinariya (Moscow)* (11): 65-67; 1980 (Russian).

General methodological aspects of mutagenicity testing of pesticides are reviewed. Four methods currently employed for estimation of the mutagenic activity of pesticides are described. These methods are estimation of gene mutations induced by chemicals in microorganisms; analysis of host-mediated mutations; induction and estimation of dominant lethals; and estimation of the frequency of chromosome aberrations in somatic and germ cells of humans and animals. It is emphasized that these methods allow estimation of all types of chromosome aberrations which play an important role in the pathogenesis of undesirable genetic sequels of exposure to environmental pollutants.

81-1769. Shulyak, V. D. (Ukrainian Res. Inst. Exp. Vet. Sci., Kiev, USSR) **Galaktoznaya proba dlya opredeleniya pestitsidov. [Galactose test for pesticide determination.]** *Veterinariya (Moscow)* (1): 74-75; 1981 (Russian).

The efficacy of functional galactose test for early detection of pesticide poisoning was studied in sheep. Animals received the pesticides Dicresyl (MTMC) and Trolen (ronnel) at 2 and 5 mg/kg, respectively for 4 and 5 mo. After termination of exposure, the animals were subjected to iv administration of galactose solution. In spite of the lack of clinical symptoms of poisoning, animals exposed to small doses of pesticides showed significant increases in the postglycemic coefficient.

81-1770. Kumaraguru, A. K.; Beamish, F. W. H. (Dep. Zool., Univ. Guelph, Guelph, Ontario N1G 2W1, Canada) **Lethal toxicity of permethrin (NRDC-143) to rainbow trout, *Salmo gairdneri*, in relation to body weight and water temperature.** *Water Res.* 15(4): 503-505; 1981 (23 references).

Studies were designed to determine the effects of temperature and body wt on the lethal toxicity of the pyrethroid insecticide permethrin to rainbow trout *(Salmo gairdneri)*. Trout of 5 wt classes (1, 5, 20, 50 and 200 g) were acclimated to water at temperatures of 5, 10, 15 and 20°C. After acclimation, bioassays were performed in which permethrin diluted in ethyl alcohol was added to tanks in a series of concentrations ranging from 0.1 to 32 μg/l. Observations were made at various intervals and fish deaths were recorded. The lethal toxicity of permethrin was seen to vary inversely with water temperature and body wt. The size effect was most pronounced between 1 and 50 g. The 96 hr LC50 for 1 g trout was 3.17 μg/l and for 5 g trout was 6.43 μg/l. In temperature tests on 1 g trout, the 96 hr LC50 increased by an order of magnitude from 0.62 to 6.43 μg/l between 5 and 20°C. Large (200 g) trout were more tolerant than small fish. The 96 hr LC50 at 15°C was 3.17 μg/l for 1 g trout and 314 μg/l for 200 g trout. It is noted that since permethrin application is likely to coincide with the usual spawning period, emerging trout fry may encounter toxic concentrations of permethrin.

81-1771. Knoetze, C.; Davies, T. R.; Wiechers, S. G. (Natl. Inst. Water Res., Pretoria 0001, South Africa) **Chemical inhibition of biological nutrient removal processes.** *Water S. A.* 6(4): 171-180; 1980 (6 references).

The inhibitory effects of organic inhibitors and various heavy metals on biological waste water treatment processes were examined in laboratory-scale activated sludge and biological rotating disc units. Bacteria obtained from denitrifying rotating disc units were transferred to a synthetic sterile medium and treated with the different inhibitors [including cadmium chloride, lead chloride, mercury chloride, phenol, zinc chloride, chlordane, carbaryl, mercaptothion (malathion), ferbam, Dithane and dichlorophenol]. After incubation at 20°C growth rate was determined by spectrophotometric turbidity measurements every 4 hr. All of the heavy metal ions tested showed no detrimental effects in raw sewage at levels ≤ 1 mg/l. The insecticides studied were tolerable at levels ≤ 10 mg/l. The fungicides ferbam and Dithane, and the acaricide dichlorophenol, were highly inhibitory to both activated sludge and rotating disc units at concentrations as low as 0.5 mg/l. No impairment of oxidation of carbonaceous matter was found in the activated sludge units, even when nitrification and denitrification were greatly inhibited and some of the mixed liquor suspended solids were killed and carried off in the effluent. When the denitrifying, nitrifying rotating disc and activated sludge units were given enough time to adapt, they all developed resistance to the inhibitors studied. Regulation of levels of heavy metals and organic inhibitors in the feed to biological waste water purification systems is stressed.

81-1772. Peters, K. S.; Tong, T. G.; Kutz, K.; Benowitz, N. L.* (Clin. Pharmacol. Unit, Med. Serv., San Francisco Gen. Hosp. Med. Cent., San Francisco, CA 94110) **Diabetes mellitus and orthostatic hypotension resulting from ingestion of Vacor rat poison: endocrine and autonomic function studies.** *West. J. Med.* 134(1): 65-68; 1981 (24 references).

The case of a 24-yr-old man, who ingested 39 g of a 2% Vacor (pyriminil) formulation in a suicide attempt, is described. He was admitted to the hospital with nausea and vomiting, abdominal pain, diffuse muscle pain, and increased frequency of micturation and thirst. Hyperglycemia, ketosis, glycosuria and ketonuria were noted upon admission and treatment with iv fluids, potassium, and continuous low-dose infusion of insulin was begun immediately. It was not learned that the patient had ingested Vacor until hospital day 2, at which time an iv infusion of 500 mg nicotinamide every 6 hr was begun and continued from days 3-7. One experience of orthostatic syncope occurred 1 wk after admission. Use of elastic stockings and oral administration of 0.3 mg fludrocortisone/day improved the degree of hypotension. Diabetes was controlled with 40 units of neutral protamine-Hagedorn insulin, administered sc each morning. It is suggested that Vacor may have specifically affected the venous circulation so that venomotor tone was not maintained by upright posture, resulting in venous pooling and hypotension.

See also 81-1504, 81-1506, 81-1508, 81-1512, 81-1513, 81-1514, 81-1515, 81-1519, 81-1520, 81-1523, 81-1526, 81-1527, 81-1529, 81-1531, 81-1532, 81-1533, 81-1534, 81-1535, 81-1536, 81-1538, 81-1539, 81-1540, 81-1541, 81-1548, 81-1565, 81-1567, 81-1569, 81-1592, 81-1597, 81-1603, 81-1611, 81-1615, 81-1620, 81-1623, 81-1626, 81-1627, 81-1628, 81-1631, 81-1632, 81-1633 *and* 81-1634.

81-1773. Nakazawa, H.; Horiba, M.; Yamamoto, S. (Inst. Biol. Sci., Sumitomo Chem. Co. Ltd., Takarazuka, Hyogo 665, Japan) **Carbon-13 nuclear magnetic resonance spectroscopy of some synthetic pyrethroids and their related compounds.** *Agric. Biol. Chem.* 44(5): 1173-1180; 1980 (7 references).

^{13}C NMR spectra were measured for 19 pyrethroids and their related compounds including allethrin, tetramethrin, resmethrin, furamethrin, phenothrin and permethrin. Complete assignment of chemical shifts was accomplished by relative spectral pattern, single-frequency off-resonance decoupling, benzene substituent effects, proton selective decoupling and use of shift reagents. The use of shift reagent was found to be especially efficient for assignment of ^{13}C resonances. In the case of allethrin, the splittings of some resonance peaks were observed originating from diastereo-isomerism. (Author abstract by permission)

81-1774. Horiba, M.; Kitahara, H.; Takahashi, K. I.; Yamamoto, S.; Murano, A. (Inst. Biol. Sci., Sumitomo Chem. Co. Ltd., Takarazuka, Hyogo 665, Japan) **Gas chromatographic determination of fenvalerate (S-5602) in technical preparations.** *Agric. Biol. Chem.* 44(5): 1197-1199; 1980 (3 references).

An analytical method is described for determining the chemical purity and diastereo-isomers of a synthetic pyrethroid, S-5602 (fenvalerate). Gas chromatography was applied and a column of 2% Apiezon L was selected to separate S-5602 from impurities. Complete separation of S-5602 was possible on this column, but separation of the diastereo-isomers was not. Base line separation of the diastereo-isomers was achieved on a column of 10% silicon DC QF-1. The isomer ratios were also determined by chromatographing 1 μl of the sample solution under the same GC conditions.

81-1775. Pansu, M.; Dhouibi, M. H.; Pinta, M. (ORSTOM, Lab. Spectrogr., FR-93140 Bondy, France) **Determination des traces de pyrethrinoides (biopermethrine et decamethrine) dans les substrats biologiques par chromatographie en phase gazeuse. [Determination of traces of biopermethrin and decamethrin pyrethroids in biological substrates through gas chromatography.]** *Analusis* 9(1-2): 55-59; 1981 (10 references) (French).

A method for determining traces of the pyrethroids biopermethrin and decamethrin is described. Samples are extracted by crushing with hexane. Extracts are dried on sodium sulfate, and purified on Florisil columns according to 2 methods based on lipid content. The concentrated eluates are then analyzed through gas chromatography on short apolar column SE 30 with an electron capture detector. This method reduced the time involved. The efficiency of extraction and purification is > 90%. The detection limit is < 2.5 pg for decamethrin. The variation coefficient is < 10%. The method was used to determine residues of these chemicals on samples of wheat and migratory locust.

81-1776. Smith, R. M.; Moraji, R. L.; Salt, W. G. (Dep. Chem., Loughborough Univ. Technol., Loughborough, Leicestershire LE11 3TU, England) **Determination of dithiocarbamates by liquid chromatography using transition-metal salts as ion-pair reagents.** *Analyst (London)* 106(1259): 129-134; 1981 (33 references).

A technique has been developed for the liquid-chromatographic determination on an octadecylsilyl silica reversed-phase column of *N*-alkyl-*NN*-dialkyldithiocarbamates by adding transition-metal salts of cobalt(II) or nickel(II) to the mobile phase. The unsuccessful use of mercury(II), copper(II), and lead(II) is discussed and the mixed complexes formed when 2 dithiocarbamates are injected are described. The retentions of the dithiocarbamates are compared with those of related thiuram disulfides (thiram and disulfiram). (Author abstract by permission)

81-1777. Hart, J. P.; Smyth, M. R.; Symth, W. F. (Dep. Orthop., Charing Cross Hosp., London W6 8RF, England) **Voltammetric determination of 2-, 3- and 4-chloroaniline in mixtures.** *Analyst (London)* 106(1259): 146-152; 1981 (18 references).

The oxidative voltammetric behavior of 2-, 3- and 4-chloroaniline (herbicide metabolites) has been investigated at the glassy carbon electrode over the pH range of 1-12. The optimum pH values for the linear-sweep and differential-pulse voltammetric determination of these compounds were found to be 1.95 for 2- and 3-chloroaniline and 8.1 for 4-chloroaniline. Differentiation of the 3 compounds in a mixture was achieved by using a combination of high-performance liquid chromatography with voltammetric detection. This method could be used to determine concentrations of 2- and 4-chloroaniline down to 2 ng and 3-chloroaniline down to 1 ng for a 20 μl injection onto the chromatographic column. (Author abstract by permission)

81-1778. Bowman, M. C.; Oller, W. L.; Cairns, T.; Gosnell, A. B.; Oliver, K. H. (Natl. Cent. Toxicol. Res., US FDA, Dep. HEW, Jefferson, AR 72079) **Stressed bioassay systems for rapid screening of pesticide residues. Part I: evaluation of bioassay systems.** *Arch. Environ. Contam. Toxicol.* 10(1): 9-24; 1981 (18 references).

An investigation of bioassay systems employing *Daphnia, Hyalella, Culex,* or *Palaemonetes* was initiated in response to the need for rapid, sensitive, and inexpensive screening procedures for toxicants in food and feed. The procedures may also be useful to determine whether farm

workers may safely reenter fields treated with pesticides. The evaluation of inherent toxicities related to types and amount of organic solvents commonly used in such systems indicated that dimethyl sulfoxide (DMSO) and methanol (MeOH) were least toxic in the aqueous test media. These solvents were then used in 18 hr tests to determine sensitivities of the 4 organisms to a representative compound from 6 classes of pesticides, i.e., dieldrin, parathion, carbaryl, atrazine, *o*-phenylphenol, and maneb. Stress factors such as the amount of organic solvent and volume of test medium were adjusted to determine their effects on 3 of the organisms tested against dieldrin and parathion. The highest sensitivity obtained with dieldrin (50% mortality with 2 ng in a 25 ml test medium) was with *Culex* stressed with 2% of MeOH in a reduced test volume. *Hyalella* stressed with 2% of MeOH were most sensitive to parathion (50% mortality with 85 pg in a 100 ml test medium); further stress imposed by reducing the volume of test medium diminished sensitivity. *Daphnia*, which were also very sensitive to dieldrin and parathion, were most sensitive to the other 4 pesticides which exhibited low toxicities to all test organisms. *Daphnia* would, therefore, be the organism of choice if only one could be used. (Author abstract by permission)

81-1779. Seiber, J. N.; Woodrow, J. E. (Dep. Environ. Toxicol., Univ. California, Davis, CA 95616) **Sampling and analysis of airborne residues of paraquat in treated cotton field environments.** *Arch. Environ. Contam. Toxicol.* 10(2): 133-149; 1981 (33 references).

A method was developed for the analysis of paraquat residues in airborne particulate matter collected by filtration or impaction. The method is based on extraction of paraquat with 6*N* hydrochloric acid, transfer of residue to saturated ammonium bicarbonate solution, and reduction of the resulting residue with alkaline sodium borohydride to a mixture of 2 tertiary amines with subsequent determination by nitrogen-selective gas chromatography (GLC). Recoveries ranged from 74 to 96% for filters spiked at 0.05 μg and above; the limit of detection is approximately 0.5 ng/m³ for high volume air samples. Paraquat concentrations measured in the air downwind from 2 commercial applications to cotton during spraying fell regularly from extrapolated interval-average values of 4.31 and 10.7 μg/m³ at the 1 m downwind edge of the 2 fields to < 50 ng/m³ at approximately 400 m downwind. Downwind samples taken 2 to 4 hr after spraying contained 1-10% as much paraquat as those during spraying, and by 5-7 hr no paraquat was detectable in the downwind air. Paraquat was also found in the airborne particulate matter during mechanical harvesting of one of the fields, the maximum interval-average values being 1242 and 516 ng/m³ just outside and inside an open cab, respectively. The analytical findings for paraquat are compared with those for *S,S,S*-tributylphosphorotrithioate (DEF), a component of the harvest aid mixture employed, and discussed in terms of occupational exposure, potential hazard, and recommended occupational practices. (Author abstract by permission)

81-1780. Chapman, J. R.; Warburton, G. A.; Ryan, P. A.; Hazelby, D. (Kratos Ltd., Urmston, Machester M31 2LD, England) **Application of the MS80 and a new high resolution selected ion monitoring routine to the determination of trace levels of TCDD.** *Biomed. Mass Spectrom.* 7(11-12): 597-599; 1980.

The MS80/DS55 mass spectrometry system was evaluated and found capable of resolving and measuring small quantities of tetrachlorodibenzodioxin (TCDD) in the presence of a large excess of other materials including the pesticide DDE. The sensitivity of the method results from new design concepts in ion source technology. The use of hexapoles enables this sensitivity to be maintained throughout the resolution range. The power of selected ion monitoring for detecting and estimating trace compounds in complex systems is significantly increased with this concept. The data are recorded by a computer controlled sweep superimposed on peak switching. The data may then be integrated over any portion of the recorded mass range to eliminate interfering materials and averaged over any time interval to improve signal-to-noise ratio. Peak profiles are continuously displayed during acquisition to serve as indicators of the progress of the experiment.

81-1781. Jackson, M. D.; Soileau, S. D. (Health Eff. Res. Lab., Environ. Toxicol. Div., US EPA, Research Triangle Park, NC 27711) **A one-step derivatization procedure for several carbamate pesticides.** *Bull. Environ. Contam. Toxicol.* 26(1): 97-101; 1981 (5 references).

Several procedures for the direct conversion of carbamates to compounds amenable to GC analysis were studied for possible application to a wide range of carbamate pesticide residues. Pentafluorobenzyl bromide was used as a derivatization reagent with 23 carbamates of widely different structures. The carbamates studied included aldicarb, aminocarb, barban, benthiocarb, carbaryl, carbofuran, CDEC, chlorpropham, desmedipham, formetanate-HCl, karbutilate, Meobal (MPMC), methiocarb, methomyl, phenmedipham, promecarb, propoxur and thiophanate-methyl. Only 5 carbamates (asulam, pebulate, propham, triallate and vernolate) did not form a derivative amenable to GC analysis. Most derivatives gave only 1 well-formed symmetrical peak. However, there was 1 minor peak each for chloropropham and Meobal and 2 minor peaks each for methomyl and phenmedipham.

81-1782. Franci, M.; Andreoni, N.; Fusi, P. (Ist. Chim. Agrar. & For., Cent. Stud. Colloidi Suolo (CRN), Univ. Firenze, I-50144 Firenze, Italy) **Identification and deter-**

mination of asulam and related degradation products in soil. *Bull. Environ. Contam. Toxicol.* 26(1): 102-107; 1981 (7 references).

The detection of asulam and its degradation products in soil was investigated. Aqueous solutions of asulam, sulfanilamide, sulfanilic acid and *p*-aminobenzenesulfonylcarbamic ion were added separately and in mixtures to soil samples, giving concentrations of 0, 0.5, 1.0, 5.0 and 10.0 ppm. Samples were extracted with $Ca(OH)_2$, distilled water and ethanol. Residues were dissolved in ethanol, and the solution was cleaned up on a silica gel column eluted with ethanol. After concentration, the eluates were transferred to thin layer chromatography plates and separated. The resulting spots were removed and quantified by extraction and colorimetric analysis. $Ca(OH)_2$ was the most effective extractant; as much as 91% asulam, 83% sulfanilimide, 90% sulfanilic acid and 79% *p*-aminobenzenesulfonylcarbamic anion were recovered.

81-1783. McIntyre, A. E.; Perry, R.; Lester, J. N. (Public Health Eng. Lab., Civ. Eng. Dep., Imp. Coll., London SW7 2BU, England) **Analysis and incidence of organophosphorus compounds in sewage sludges.** *Bull. Environ. Contam. Toxicol.* 26(1): 116-123; 1981 (11 references).

An evaluation was made of analytical procedures for the determination of organophosphorus insecticides in waste waters and sewage sludges. Gas chromatographic analyses of standard solutions of diazinon, malathion and parathion, each carried through two cleanup procedures, yielded recoveries ranging from 89.5 to 102.0%. Recoveries of organophosphorus compounds from sludges were higher using the Ultra-Turrax homogenizer than with the separatory funnel. Adequate recoveries were also obtainable on smaller volumes of sample using the laboratory disperser cleanup method. Sewage sludge samples were also collected from twelve United Kingdom sewage treatment works to survey the extent of contamination by organophosphorus compounds. Results using the disperser method showed no detectable levels in 9 of the 12 sludges tested. Three of the samples contained prominant peaks which were tentatively identified as breakdown products of parent organophosphorus compounds used as flame retardants.

81-1784. Chang, J. C.; Taylor, P. B.; Leach, F. R. (Dep. Biochem., Oklahoma State Univ., Stillwater, OK 74078) **Use of the Microtox assay system for environmental samples.** *Bull. Environ. Contam. Toxicol.* 26(2): 150-156; 1981 (18 references).

The Microtox assay system for measuring water pollution is based on rehydrating freeze-dried luminescent bacteria and measuring the effect of potential inhibitors under defined conditions on light production. The usefulness of this method in a bioassay system was evaluated for several standard toxic compounds, selected respiratory inhibitors, various pesticides and typical environmental water samples. The pesticides tested included captafol, carbaryl, cyhexatin, diazinon, dichloran, DDT, glyphosate, malathion, paraquat, ridomil (metalaxyl) and thiabendazole. Advantages of the Microtox test were the short time required (30 min), and the statistical advantage in using over 100,000 bacteria instead of a small number of rats or fish as in the other bioassays. The Microtox had a correlation coefficient of 0.90 with rat toxicity and 1.0 with fish toxicity.

81-1785. Kostalkowska, H.; Kotarski, A.; Missala, I. (Dep. Anal., Inst. Org. Ind., Warsaw, Poland) **Analiza mieszanin herbicydow w formach uzytkowych metoda wysokocisnieniowej chromatografii cieczowej. [Analysis of mixtures of herbicides in formulated products by high pressure liquid chromatography.]** *Chem. Anal. (Warsaw)* 25(5): 821-827; 1980 (13 references) (Polish).

The compositions of two mixtures, each containing three herbicides, were determined by high pressure liquid chromatography. The first mixture contained nitrofen, monolinuron, and chlortoluron. The second mixture contained terbutryne, linuron, and methabenzthiazuron. The liquid chromatograph was used without a pump and with a UV-254 detector. The first mixture was separated on Lichrosorb Si 60 (30 μm) with hexane + isopropyl alcohol (90:10). The second mixture was separated using the same adsorbent and dichloroethene + *n*-hexane + isopropyl (10:88:2) as the mobile phase. Resolution was better than 1.5. The auxiliary substances which were present in the formations had no effect on the analysis. The relative standard deviation was 0.02-0.04, and the percent recoveries ranged from 97.8 to 106.4%.

81-1786. Lazzarini, C.; Rossi, E.; Del Re, A. (Ist. Chim. Org., Fac. Agrar., Univ. Cattol. Sacro Cuore, Piacenza, Italy) **Determinazione di residui di etilentiourea in vini mediante cromatografia liquida ad alta pressione (HPLC). [Determination of ethylenethiourea in wines by high-pressure liquid chromatography.]** *Chim. Ind. (Milan)* 62(12): 923-926; 1980 (24 references) (Italian).

An inversed-phase liquid-liquid high-pressure chromatographic method was developed for the quantitative determination of ethylenethiourea (ETU), a potentially carcinogenic derivative of ethylene-bis-dithiocarbamates, in wines. The results of analyses of Italian wines are presented. The method involves extraction of ETU residues from wine with methylene chloride in the presence of sodium sulfate. The extracts are purified on alumina, and determined chromatographically at 244 nm without derivatization. The recovery rate from wines is 60-75% in the concentration range of 0.04-0.12 ppm. The detection limit is ~ 2 ng (corresponding to 25 ppb in wine). With a

practical detection limit of ≤ 0.025 ppm, no ETU residues were found in 24 Italian wines analyzed (1977 and 1978 vintages).

81-1787. Razumas, V. J.; Kulys, J. J.; Malinauskas, A. A. (Inst. Biochem., Lithuanian Acad. Sci., Vilnius, USSR) **High-sensitivity bioamperometric determination of organophosphate insecticides.** *Environ. Sci. Technol.* 15(3): 360-361; 1981 (8 references).

The present paper reports on the development of a simple bioamperometric method for the analysis of insecticides, based on the inhibition of cholinesterase catalysis of the indoxyl acetate hydrolysis. According to the inhibition capacity, the insecticides studied arrange themselves into a series: chlorophos (trichlorfon) > benzophosphate (phosalone) > methylnitrophos (fenitrothion) > carbophos (malathion) > phosphamide (dimethoate) > Antio (formothion). The method enables determination of the total concentration of organophosphate compounds in the interval 10-600 pmol in 0.1 ml of the sample. (Author abstract reprinted by permission of the American Chemical Society)

81-1788. Inui, T.; Terada, S.; Tamura, H. (Shizuoka Prefect. Ind. Res. Inst., Shizuoka, Japan) **Determination of arsenic by arsenic generation with reducing tube followed by graphite furnace atomic absorption spectrometry.** *Fresenius Z. Anal. Chem.* 305(3): 189-192; 1981 (6 references).

A sensitive method for hydride generation and graphite tube furnace atomic absorption spectrometry measurements with a reducing tube has been developed for the determination of arsenic in tea and orchard leaves. Arsines were generated in a horizontal glass tube, in which a pellet of $NaBH_4$ was placed. A 1.5-2.0 ℓ/min argon flow rate and 2400°C atomization temperature were the best experimental conditions. The strong suppression of the arsenic signal by Ni and Co was effectively eliminated with 1,10-phenanthroline. A detection limit of 0.3 ng was obtained with a precision of 3-4%. (Author abstract by permission)

81-1789. Vincze, A.; Gefen, L.; Fisher, A.; Shatkay, A.; Saranga, R. (Israel Inst. Biol. Res., Ness-Ziona, Israel) **Gas-chromatographic quantitation of lindane in household insecticide spray cans.** *Fresenius Z. Anal. Chem.* 305(3): 193-195; 1981 (8 references).

A method was developed for the determination of the lindane content of commercial household insecticide spray aerosols. After the propellent is removed from the chilled contents of the spray packages, the hydrocarbon solution is analyzed for lindane content by electron-capture gas chromatography. Pure α-isomer of hexachlorocyclohexane serves as the internal standard. Experimental error is ± 5%. (Author abstract by permission)

81-1790. Petrowitz, H. J.; Wagner, S. (Bundesanst. Materialpruef., Fachgr. Biol. Materialpruef., D-1000 Berlin 45, BRD) **Duennschicht-Chromatographie von insecticiden und fungiciden Wirkstoffen in oeligen Holzschutzmitteln. [Thin-layer chromatography of insecticidal and fungicidal agents in oil-borne wood preservatives.]** *Fresenius Z. Anal. Chem.* 305(3): 196-199; 1981 (18 references) (German).

During the past years a number of new substances with insecticidal and fungicidal properties have been incorporated into oil-borne wood preservatives. Among them are endosulfan (I), tributyl-tinoxide (II), dichlofluanid (III), Xyligen A1 (IV) and Xyligen B (V). For the detection of these compounds in commercial oil-borne wood preservatives and wood extracts by thin-layer chromatography, silica gel layers have been employed as were the following solvents, detecting reagents: toluene:hexane (50:50), tetramethylbenzidine; alcohol:water mixtures, pyrocatechol violet; CCl_4:$CHCl_3$ (50:50), tetramethylbenzidine; mixtures of aromatic hydrocarbons with alcohols or ketones, ferric chloride; and $CHCl_3$:CH_3OH (98:2) or toluene:ethyl acetate (90:10), modified Dragendorff reagent. (Author abstract by permission)

81-1791. Holler, J. S.; Yert, L. W.; Patterson, D. G.; Smrek, A. L.; Needham, L. L. (Cent. Dis. Control, Public Health Serv., US Dep. Health & Hum. Serv., Atlanta, GA 30333) **Characterization of interferences in the analysis of serum for DDT and its metabolites.** *J. Chromatogr.* 206(3): 617-620; 1981 (16 references).

A series of contaminants was encountered during the gas chromatographic analysis for DDT and its metabolites in human serum. Further study indicated that the interfering compounds were a series of low-molecular-wt polymeric materials extracted by hexane from a Kel-F valve in the solvent dispensing system. The 3 intermittent peaks of primary interest which interfered in the quantitation of DDT and metabolites were located at 0.26, 0.60 and 1.63 relative to *p,p'*-DDE. Examination of the Kel-F valve in the solvent dispensing system showed that the polymer is composed of trifluorochloroethylene units. This system leaches these fluorochlorocarbon contaminants in the process of dispensing hexane. The fact that this particular solvent was used only to calibrate glassware for volume and was not in use during the extraction procedure caused the appearance of these compounds to be very sporadic and caused difficulty in arriving at an explanation.

81-1792. Phelan, P. L.; Miller, J. R. (Dep. Entomol., Univ. California, Riverside, CA 92521) **Separation of isomeric insect pheromonal compounds using reversed-phase HPLC with $AgNO_3$ in the mobile phase.** *J. Chromatogr. Sci.* 19(1): 13-17; 1981 (13 references).

An approach for separating positional isomers and

geometrical isomers of mono-, di-, and polyunsaturated insect pheromones is reported which uses reversed-phase HPLC with a polar mobile phase containing silver nitrate. While the technique cannot be used under all conditions, it is more flexible than other methods as it effects rapid separation regardless of the polarity of the solute. Use of columns with different bonded phases and different compound selectivities will aid in refining the technique. Separations of adjacent positional isomers of dodecenyl acetate were also attempted. The degree of success in these last trials was dependent on the double bond distance from the acetate group.

81-1793. Stalling, D. L.; Petty, J. D.; Smith, L. M. (Columbia Natl. Fish. Res. Lab., US Fish & Wildl. Serv., Columbia, MO 65201) **Chromatographic enrichment of acidic compounds from organic solvents using alkali metal silicates.** *J. Chromatogr. Sci.* 19(1): 18-26; 1981 (25 references).

Alkali metal (Li, Na, Ki and Cs) hydroxide-treated silica gels were evaluated for their ability to retain, separate, and enrich trace residues of acidic components, especially substituted phenols. The method is applicable to determination of residues (including 2,4-D and picloram) in tissues, soil and water. Retention of acid compounds increased with increasing ionic radius of the alkali metal. Cs silicate was clearly superior for retention of sterically-hindered phenols such as 2,4-6-trimethylphenol, but BHT, 2,6-ditertiarybutyl-4-methyl phenol, did not react with any silica gel tried. Samples were applied to columns 1.0 × 8.5 cm in methylene chloride/cyclohexane 1:1 by volume and eluted with this solvent or 0 to 50% methanol mixed with this solvent.

81-1794. Egan, H. (Lab. Gov. Chem., London SF1 9NQ, England) **Organic and inorganic compounds. Analytical aspects.** In: *Monitoring Environmental Materials and Specimen Banking*. Luepke, N. P., ed. (Martinus Nijhoff Publ.: The Hague): pp. 230-246; 1979 (22 references).

A review is presented of analytical aspects for each of the main groups of pollutants, with special reference to the limits of detection. It is pointed out that both the required detection limits and sample substrates vary, depending on the pollutant. The classes of pollutants discussed include nitrosamines, pesticide residues, vinyl chloride monomer, antibiotic residues, synthetic hormones, mycotoxins, asbestos fibers, trace metals, polynuclear aromatic hydrocarbons, and other hydrocarbons. For each class of compounds, currently used analytical methods, appropriate specimen samples, and detection limits are discussed. Regarding pesticide residues, the compounds of greatest interest in recent years have been the organochlorine compounds, mainly dieldrin, HCH (BHC), DDT, and their degradation products. The analytical methods used include gas-liquid, thin-layer and high-pressure liquid chromatography, and high-resolution mass spectrometry. With gas-liquid chromatography, limits of 0.001 mg/kg are attainable. Residues in biological tissues in deep-freeze storage were found to be stable for up to 1 yr. Organophosphorus pesticide residues, which are generally less persistent, can be analyzed by similar methods, with detection limits of 0.003 mg/kg.

81-1795. Dias, J. R.; Zigon, M.; Gomiscek, S. (Dep. Chem., Univ. Missouri, Kansas City, MO 64110) **Mass spectral fragmentation of metal dithiocarbamate complex salts.** *Org. Mass Spectrom.* 16(1): 12-16; 1981 (12 references).

A systematic mass spectral study of metal dithiocarbamate complex salts is presented. Volatile impurities that may frequently form concurrently in the preparation of metal dithicarbamate salts were identified as primarily thiurams and thioureas. The 70 eV spectra of NH_4(diethyldithiocarbamate), NH_4(pentamethylenedithiocarbamate), and Pb(tetramethylenedithiocarbamate), and the 12 eV spectra of Cu(tetramethylenedithiocarbamate), Pb(tetramethylenedithiocarbamate), and Zn(tetramethylenedithiocarbamate), are reported. It is noted that only divalent dithiocarbamate ions exhibit both L and (L-H) losses. Structural information has been inferred concerning the identity of these divalent ions.

81-1796. Hideg, Z. (Natl. Inst. Forensic Chem., Budapest, Hungary) **A kolineszteraz-aktivitas meghatarozasa Ellmann modositott modszerevel post mortalis vermintakbol. [Determination of cholinesterase activity by a modified version of Ellmann's method in postmortem blood samples.]** *Orv. Hetil.* 122(4): 221-222; 1981 (7 references) (Hungarian).

A modification of Ellman's method which allows the simple, rapid determination of whole blood cholinesterase activity in putrefied blood is presented. The reagents used are acetylcholine iodide solution and a solution of 10 mg 5-5′-dithio-bis-(2-nitrobenzoic acid) in 100 ml 0.061 *M* Sorensen phosphate buffer. The enzyme activity is determined spectrophotometrically at 426 nm. The time requirement of the new method is 10% that of Michel's method. The standard error is 33% that of Michel's standard method.

81-1797. Lynch, V. P.; Hudson, H. R.; Pianka, M. (Murphy Chem. Ltd., Wheathampstead, Hertfordshire AL4 8QU, England) **Identification and determination of mecarbam and its major degradation products in water and crops.** *Pestic. Sci.* 12(1): 65-73; 1981 (25 references).

Methods have been developed for the analysis by

gas-liquid chromatography and thin-layer chromatography of mecarbam and a number of its degradation products which result from oxidation and/or partial hydrolysis. In acid solution, mecarbam was found to be relatively stable but it decomposed more readily under alkaline conditions to give *O,O*-diethylhydrogen phosphorodithioate by fission of the sulfur-carbon bond. At pH 9.2, the half-life at room temperature was about 44 hr. For residue analysis, a clean-up procedure with Florisil was found to be preferable to one which employed alumina, as the latter caused cleavage of the ethoxycarbonyl group under certain conditions. Field trials with olives, oranges and pears showed that the parent pesticide, mecarbam, was the only significant detectable residue at any stage from treatment to harvesting, and that it tended to concentrate in the oil-containing portion of the crop. Low levels of *O,O*-diethyl *S*-methylcarbamoylmethyl phosphorodithioate were also detected in residues from lucerne and from bean plants, and it was shown that this same metabolite could be formed photolytically on filter paper or (more rapidly) on dock leaves. *S*-(*N*-Ethoxycarbonyl- *N*-methylcarbamoylmethyl) *O,O*-diethyl phosphorothioate was detected only in bean plants and then, at a level of less than 0.1 mg/kg. (Author abstract by permission)

81-1798. Cayley, G. R.; Hide, G. A.; Tillotson, Y. (Rothamsted Exp. Stn., Harpenden, Herts AL5 2JQ, England) **The determination of imazalil on potatoes and its use in controlling potato storage diseases.** *Pestic. Sci.* 12(1): 103-109; 1981 (11 references).

Methods were developed to extract, and determine the concentration of, imazalil in potatoes. To assess the amount of imazalil on the surface of potatoes, individual tubers were placed in Kilner jars and extracted with sulfuric acid. The acid was filtered off, and an aliquot was made alkaline with sodium hydroxide. The imazalil was then partitioned into toluene. Within several hours after treatment, the acid wash was no longer able to extract imazalil. Tubers were peeled, and the peelings were macerated with methanol containing sodium hydroxide. The mixture was filtered, and the filtrate was acidified with sulfuric acid. Methanol was removed via evaporation. Ammonia was added to the residue, followed by toluene. Toluene was removed after shaking and dried over anhydrous sodium sulfate. The imazalil in the toluene extract was determined by gas-liquid chromatography or by high-pressure liquid chromatography. In storage trials tubers were treated with fungicides and stored for 26, 32 or 35 wk. Imazalil was applied at 10 g/ton immediately after harvest. Residues after storage at 7°C for 26 wk ranged from 14 to 88% of levels detected immediately after treatment.

81-1799. Mustafa, M.; Narsaiah, J.; Abedi, A.; Osmani, Z. (Div. Entomol., Reg. Res. Lab., Hyderabad 500009, India) **Laboratory bioassay of systemic insecticides on *Dysdercus cingulatus* F.** *Pesticides* 14(10): 6-9; 1980 (13 references).

Three methods for bioassay of systemic insecticides were compared. The test insect was the red cotton bug *(Dysdercus cingulatus)* The insecticides tested were monocrotophos and phosphamidon. The bent tube (BT) method utilizes a calibrated, J-shaped, glass tube with a stopcock; the lower end of the tube projects through a cork and into a small glass cylinder containing the test organism. The insects feed on aqueous pesticide solutions from the tube; amounts ingested are controlled by the stopcock. In the cut twig (CT) method, the end of a fresh-cut cotton twig, bearing a green cotton boll and 1-2 leaves, is dipped into a flask containing an aqueous solution of pesticide. After 24 hr, insects are allowed to feed on the cotton boll. The soaked seed (SS) method consists of washing and then feeding seeds, soaked in aqueous insecticide solutions for 24 hr, to cotton bugs. The order of efficiency of the methods for both insecticides on male cotton bugs was found to be BT > CT > SS. However, the bent tube method is the most time-consuming, and it is suggested that it would be best suited for exacting work. The other 2 methods are ideal for rapid bioassay work, however, since results on 4-5 concentrations can be obtained in 2 days.

81-1800. Chmil', V. D. (All-Union Res. Inst. Hyg. & Toxicol. Pestic. Polym. & Plast., Kiev, USSR) **Gruppovye metody kontsetrirovaniya sledovykh kolichestv pestitsidov pri ikh opredelenii i vode. [Group preconcentration of trace pesticides in water analysis.]** *Zh. Anal. Khim.* 35(12): 2413-2417; 1980 (10 references) (Russian).

Determination methods for trace amounts of pesticides and their degradation products in water were developed. Water samples containing a mixture of pesticides was subjected to consecutive concentration (passage through 3 ion-exchange columns) followed by gas-liquid and thin-layer chromatography. The method provided for separate determination of substituted phenylureas, chlorophenols, nitrophenols, triazines, dipyridyls, chlorinated hydrocarbons, chlorocarboxylic, chlorophenoxyalkancarboxlyic and chlorobenzoic acids, and derivatives of phosphoric, thiophosphoric, and phosphonic acid. A 100-200 fold concentration of trace amounts of pesticides was achieved. Sensitivity of the technique was 0.01-1.0 μg/l.

See also 81-1506, 81-1526, 81-1549 *and* 81-1769.

PESTICIDES ABSTRACTS

QUARTERLY INDEX

APRIL—JUNE, 1981, VOL. 14, Nos. 4–6

PREFACE

The basic design for this index was supplied by the Management Support Division, Office of Pesticides and Toxic Substances, Environmental Protection Agency. It consists of two subject indexes (concept and compound) and two author indexes (personal and corporate). Primary and secondary headings in the Concept Index appear as subordinate headings in the Compound Index, both indexes having three levels of specificity.

In the Concept Index, only general aspects are indexed under the broader terms shown below. For specific terms, the reader should consult the appropriate heading in the Concept Index, selecting the narrower term that best fits his need.

Compounds are indexed by their common names; where other designations are used by authors, these synonyms appear with the notation to *see* the common name. Articles referring, in general, to structural or functional chemical classes are indexed under the broader headings (e.g., organochlorines, herbicides, etc.).

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